19960045486 Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov, USSR

Aberration of focusing channel in RFQ linac ***Aberratsii fokusiruyushchego kanala s vysokochastotnoj prostranstvenno-odnorodnoj kvadrupol'noj fokusirovkoj***

Kozlov, A.V., Academy of Sciences (USSR), USSR; Mal't-sev, A. P., Academy of Sciences (USSR), USSR; 1994, 14p; In Russian

Report No.(s): IFVE-OLU-94-140; DE96-622822; Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

Aberrations influences on the particle beam in the channel of Radio Frequency Quadrupole (RFQ) accelerator are investigated. It is cleared up, that are connected with different RF field components and phases, compensate mutually. The average rate of accumulating of nonlinearity distorsions of the beam in RFQ channel is less than one in similar static quadrupolar channel with similar spectrum of azimuthal harmonics.

DOE

Emittance; Beams (Radiation); Aberration; Quadrupoles; Linear Accelerators

19960045546 Joint Inst. for Nuclear Research, Lab. of High Energy Physics., Dubna, USSR

Methods and systems for diagnostics of electron beams by synchrotron infrared radiation

Mal'tsev, A. A., Joint Inst. for Nuclear Research, USSR; Mal'tsev, M. A., Joint Inst. for Nuclear Research, USSR; 1995, 14p; In English

Report No.(s): JINR-E-9-95-489; DE96-622823; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The method using a synchrotron radiation of electrons is one of the most effective for the ring beam observing in the ERA without its destruction. The results are presented of the infrared ((lambda)(approx) greater than 1 micrometer) synchrotron radiation using for the diagnostics of the compressed in the ERA ring beam of charged particles.

DOE

Angular Distribution; Beams (Radiation); Charged Particles; Electron Beams; Infrared Radiation; Synchrotron Radiation

74 OPTICS

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

19960042704 Dept of the Navy, Washington, DC USA

Optical Correlator Using Optical Delay Loops

Garcia, Joseph P., Inventor, Department of the Navy, USA; Nov. 22, 1995, 15p; In English

Patent Info.: US-Patent-Appl-SN-562920

Report No.(s): AD-D017927; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

An optical correlator is disclosed that compares signals of interest with selected reference signals stored in holograms. The holograms are arranged so that the selected reference signals impinge onto the plane of the entrance of fiber optics arranged with an optical delay line and fiber optic amplifiers to form a delay line amplifier array. The optical delay line receives the signals of interest represented by light modulated pulses. The cooperative action from the light from the hologram and the light from the optical delay line produces signals that are proportional to the correspondence between the signals of interest and the stored reference signals.

DTIC

Optical Correlators; Signal Processing; Fiber Optics; Optical Communication; Holography

19960042768 Los Alamos National Lab., NM USA

Artificially structured nonlinear optical and electro-optic materials

Donohoe, R., Los Alamos National Lab., USA; Bishop, A., Los Alamos National Lab., USA; Buscher, C., Los Alamos National Lab., USA; Gammel, J., Los Alamos National Lab., USA; Li, Dequan, Los Alamos National Lab., USA; McBranch, D., Los Alamos National Lab., USA; Saxena, A., Los Alamos National Lab., USA; Yang, Xiaoguang, Los Alamos National Lab., USA; [1996], 10p; In English

Contract(s)/Grant(s): W-7405-eng-36

Report No.(s): LA-UR-96-1029; DE96-008193; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This is the final report of a 3-year project. Emerging electro-optic technologies, including optical signal processing, switching, and data manipulation, require high performance, processable nonlinear optical (NLO) and electro-optic (EO) materials. The aim of this project is to combine physical characterization and materials modelling to guide a rational synthesis of artifically structured materials optimized for NLO and EO applications. New materials consisting of chromophores optimized for the red and near-infrared spectral region, directly attached to optical substrates using covalent bonding of self-assembled mono- and multi-layers have been produced and their NLO response measured. A second strategy, based on construction of multiple heterojunctions of one-dimensional solids, is also being explored. Results of CW and ultrafast optical and Raman spectroscopy of these materials demonstrate the highly polarizable nature of the junctions, confirming the NLO potential of the materials. Overall goal was to develop these synthetic approaches through a combined synthesis, characterization, and theoretical effort where materials modeling, benchmarked by observed physical prop-

erties, is used to guide rational synthesis of advanced electronic materials.
DOE
Electro-Optics; Optical Materials; Chromophores; Heterojunctions; Nonlinearity; Harmonic Generations

19960042786 Department of the Navy, Washington, DC USA
Optical Correlator Using Spatial Light Modulator
Garcia, Joseph P., Inventor, Department of the Navy, USA; Welsh, Lisa P., Inventor, Department of the Navy, USA; Nov. 27, 1995, 29p; In English
Patent Info.: US-Patent-Appl-SN-562919
Report No.(s): AD-D017921; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

An optical correlator is disclosed that compares signals of interest against selected reference signals stored in holograms both of which are imaged onto a spatial light modulator comprising electron trapping material. The cooperative action of the light from the hologram and the light from a delayed line ca uses the spatial light modulator to produce signals that are proportional to the correspondence between the signals of interest and the reference signals.
DTIC
Optical Correlators; Light Modulators; Signal Processing; Electro-Optics

19960042869 Eastman Kodak Co., Rochester, NY USA
AXAF Alignment Test System Autocollimating Flat Error Correction
Lewis, Timothy S., Eastman Kodak Co., USA; Jul. 11, 1995, 12p; In English; SPIE International Society for Optical Engineers Conference, 11 Jul. 1995, San Diego, CA, USA
Contract(s)/Grant(s): NAS8-37710
Report No.(s): NASA-CR-201486; NAS 1.26:201486; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The alignment test system for the advanced x ray astrophysics facility (AXAF) high-resolution mirror assembly (HRMA) determines the misalignment of the HRMA by measuring the displacement of a beam of light reflected by the HRMA mirrors and an autocollimating flat (ACF). This report shows how to calibrate the system to compensate for errors introduced by the ACF, using measurements taken with the ACF in different positions. It also shows what information can be obtained from alignment test data regarding errors in the shapes of the HRMA mirrors. Simulated results based on measured ACF surface data are presented.
Author
X Ray Astrophysics Facility; Alignment; Paraboloid Mirrors; Collimation; Flat Surfaces; Fourier Analysis

19960042885 Lawrence Livermore National Lab., Livermore, CA USA
Applications of high average power nonlinear optics
Velsko, S. P., Lawrence Livermore National Lab., USA; Krupke, W. F., Lawrence Livermore National Lab., USA; Feb. 05, 1996, 18p; In English; Photonics West 1996, 27 Jan. - 2 Feb. 1996, San Jose, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123041; CONF-960163-10; DE96-007601; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nonlinear optical frequency convertors (harmonic generators and optical parametric oscillators are reviewed with an emphasis on high average power performance and limitations. NLO materials issues and NLO device designs are discussed in reference to several emerging scientific, military and industrial commercial applications requiring (approx.) 100 watt average power level in the visible and infrared spectral regions. Research efforts required to enable practical (approx.) 100 watt class NLO based laser systems are identified.
DOE
Harmonic Generators; Parametric Amplifiers; Nonlinear Optics; Infrared Radiation; Optical Radar

19960042957 Argonne National Lab., IL USA
A new application for x-ray lithography: Fabrication of blazed diffractive optical elements with a deep phase profile
Makarov, Oleg A., Argonne National Lab., USA; Chen, Zheng, Wisconsin Univ., USA; Krasnoperova, Azalia A., Wisconsin Univ., USA; Cerrina, Franco, Wisconsin Univ., USA; Cherkashin, Vadim V., Academy of Sciences (USSR), USSR; Poleshchuk, Alexander G., Academy of Sciences (USSR), USSR; Koronkevich, Voldemar P., Academy of Sciences (USSR), USSR; [1996], 7p; In English; 1996 International Society for Optical Engineering (SPIE) International Symposium on Microlithography, 11-15 Mar. 1996, Santa Clara, CA, USA
Contract(s)/Grant(s): W-31109-eng-38
Report No.(s): ANL/XFD/CP-89660; CONF-9603140-2; DE96-009050; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Use of x-ray lithography to produce blazed diffractive optical elements (DOEs) is described. Proposed method allows one to make highly efficient blazed DOE with a deep phase profile (ten wavelengths and more) using a single x-ray mask with a binary transmission pattern. Unlike the well-known multilevel DOEs, blazed ones do not involve fabrication and aligning of a set of masks. DOEs with a profile depth of 10 (mu)m and more and zone sizes down to 1 (mu)m can be obtained due to the short wavelength and high penetrability of x rays. The first experimental samples of blazed DOEs with a 10 (mu)m-height profile--lenses and gratings - were fabri-

cated by x-ray lithography with synchrotron radiation using the x-ray masks, prepared in accordance with the pulse-width modulation algorithm. Diffraction efficiency for lenses was measured for white light: it is higher than 80% for the central part of the lenses (inside a 10 mm diameter) and about 60% for an area of 20 mm diameter.
DOE
Synchrotron Radiation; Pulse Duration Modulation; Lithography; X Rays

19960042966 Brookhaven National Lab., Upton, NY USA
Frequency-resolved optical grating using third-harmonic generation
Tsang, Thomas, Brookhaven National Lab., USA; Krumbuegel, Marco A., Sandia National Labs., USA; Delong, Kenneth W., Sandia National Labs., USA; Fittinghoff, David N., Sandia National Labs., USA; Trebino, Rick, Sandia National Labs., USA; Dec. 1995, 4p; In English; 10th; International Topical Meeting and Tabletop Exhibition on Ultrafast Phenomena, 28 May - 1 Jun. 1996, Coronado, CA, USA
Contract(s)/Grant(s): DE-AC02-76CH-00016
Report No.(s): BNL-62576; CONF-960541-1; DE96-005585; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We demonstrate the first frequency-resolved optical gating measurement of an laser oscillator without the time ambiguity using third-harmonic generation. The experiment agrees well with the phase-retrieved spectrograms.
DOE
Ruby Lasers; Harmonic Generations; Frequency Measurement

19960042973 Sandia National Labs., Albuquerque, NM USA
Nanosecond optical parametric oscillators produce phase modulated light
Armstrong, D. J., Sandia National Labs., USA; Smith, A. V., Sandia National Labs., USA; [1996], 7p; In English; 16th; 6th; Annual Conference on Lasers and Electro-Optics, 2-7 Jun. 1996, Anaheim, CA, Anaheim, CA, USA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-1138C; CONF-960642-14; DE96-010555; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have found that nanosecond optical parametric oscillators pumped well above threshold by single longitudinal mode pulse produce signal and idler light that is nearly purely phase modulated, even for unseeded operation.
DOE
Optical Pumping; Parametric Amplifiers; Phase Modulation

19960043040 Lawrence Livermore National Lab., Livermore, CA USA
OPO performance with an aberrated input pump beam
Neumann, W. A., Lawrence Livermore National Lab., USA; Jan. 27, 1996, 16p; In English; Photonics West, 27 Jan. - 2 Feb. 1996, San Jose, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123040; CONF-960163-9; DE96-007592; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The performance of an optical parametric oscillator (OPO) with non-ideal input pump fields is investigated numerically. The analysis consists of a beam propagation calculation based on Fourier methods including walk-off in the non-linear crystal coupled with the three-wave interaction in the crystal. The code is time dependent enabling analysis of laser pulses. The pump beam aberrations are described by Zernike polynomials. The OPO investigated is a LiNbO3 crystal in a flat-flat resonator. The LiNbO3 crystal is cut to produce a 1.5 micron signal and 3.6 micron idler from a 1.06 micron input pump field. The results show that the type of aberration is significant when predicting the output performance of the OPO and not simply the beam quality or M(exp 2) angular divergence of the pump beam. While thresholds for input pump beams with M(exp 2) = 2 only increase on the order of 10% over unaberrated beams, the divergence of the output fields can be much worse than the pump beam divergence. The output beam divergence is also a function of the input pump energy. Aberrated pump fields can also lead to angular displacements between the generated signal and idler fields.
DOE
Parametric Amplifiers; Polynomials; Lithium Niobates; Laser Beams; Crystal Optics; Laser Pumping; YAG Lasers; Pulsed Lasers; Laser Outputs

19960044452 Lawrence Livermore National Lab., Livermore, CA USA
Keck adaptive optics: Control subsystem
Brase, J. M., Lawrence Livermore National Lab., USA; An, J., Lawrence Livermore National Lab., USA; Avicola, K., Lawrence Livermore National Lab., USA; Mar. 08, 1996, 10p; In English; Society of Photo-optical Instrumentation Engineer (Spie) Summer Topical Meeting on Adaptive Optics, 8 -12 Jul. 1996, Maui, HI, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123778; CONF-9607112-4; DE96-010828; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Adaptive optics on the Keck 10 meter telescope will provide an unprecedented level of capability in high resolution ground based astronomical imaging. The system is designed to provide near diffraction limited imaging performance with Strehl (gt) 0.3 n median Keck seeing of r0 = 25 cm, T =10 msec at 500 nm wavelength. The system will be equipped with a 20 watt sodium laser guide star to provide nearly full sky coverage. The wavefront control subsystem is responsible

for wavefront sensing and the control of the tip-tilt and deformable mirrors which actively correct atmospheric turbulence. The spatial sampling interval for the wavefront sensor and deformable mirror is de=0.56 m which gives us 349 actuators and 244 subapertures. This paper summarizes the wavefront control system and discusses particular issues in designing a wavefront controller for the Keck telescope.
DOE
Control Systems Design; Adaptive Optics; High Resolution; Imaging Techniques; Laser Guide Stars; Telescopes

19960045213 Lightwave Electronics Corp., Mountain View, CA USA
Compact Mid-Infrared Source ***Final Report, 10 Mar. - 20 Sep. 1995***
Bosenberg, Walter R., Lightwave Electronics Corp., USA; Sep. 20, 1995, 26p; In English
Contract(s)/Grant(s): DAAB07-95-C-M046
Report No.(s): AD-A304709; NV-96-C-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This effort successfully demonstrated a high power periodically poled lithium niobate (PPLN) optical parametric oscillator (OPO) operating in the mid-infrared region of the spectrum. Highlighted experimental results are: (1) generation of 600 mW of 3.5 micron radiation (from 5.8 W pump); (2) generation of 2 W of 1.54 micron radiation (5.8 W pump); (3) operation at repetition rates of 5-32 kHz; (4) tuning over 2.7 to 4.8 micron (idler) and 1.35 - 1.66 micron (signal); and (5) expanding our PPLN fabrication capabilities by poling full 3 inch diameter wafers, and poling 0.75 mm and 1.0 mm thick crystals. This work clearly demonstrates that PPLN OPOs are capable of generating high repetition rate mid-infrared radiation at Watt power levels.
DTIC
Light Amplifiers; Parametric Amplifiers; Lithium Niobates; YAG Lasers; Laser Pumping; Optical Materials

19960045242 Allied-Signal Aerospace Co., Kansas City, MO USA
Optical devices for turning an exit fiber optic beam through 90 degrees within a small region in space
Klingsporn, P. E., Allied-Signal Aerospace Co., USA; Jun. 1996, 62p; In English
Contract(s)/Grant(s): DE-AC04-76DP-00613
Report No.(s): KCP-613-5660; DE96-011924; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The beam emerging from an optical fiber in general diverges quite rapidly within a short distance from the exit face. In applications requiring a fiber beam to be turned through 90 degrees within a region of space much smaller than the fiber can be bent, it is necessary not only to turn the exited beam through 90 degrees, but also to transform it from a diverging beam to one of convergence, particularly when the turned beam is to be received by a second fiber or is required to have a fluence in some plane nearly equal to that within the original fiber. to this end, fiber optic devices for turning an exit fiber through 90 degrees in a small region of space were designed on the basis of simple geometric optics. One design involves a combination of a spherical lens and a right angle prism. Another design utilizes a half-sphere lens with its diametrical face at 45 degrees to the path of the exit fiber beam. Prototype devices of both designs were fabricated, and measurements were made of the transmitted intensity distributions. An exact ray tracing analysis was conducted for both right-angle fiber beam turning devices.
DOE
Fiber Optics; Fabrication; Geometrical Optics; Optical Fibers; Optical Equipment

19960045320 Sandia National Labs., Albuquerque, NM USA
Basic issues associated with four potential EUV resist schemes
Wheeler, David R., Sandia National Labs., USA; Kubiak, Glenn, Sandia National Labs., USA; Ray-Chaudhuri, Avijit, Sandia National Labs., USA; Henderson, Craig, Sandia National Labs., USA; [1996], 7p; In English; Optical Society of America (OSA) Meeting on Integrated Photonics Research, 29 Apr. - 3 May 1996, Boston, MA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-1106C; CONF-960493-8; DE96-010561; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Four of the better developed resist schemes that are outgrowths of DUV (248 and 193 nm) resist development are considered as candidates for EUV. They are as follows: trilayer, a thin imaging layer on top of a refractor masking/pattern transfer layer on top of a planarizing and processing layer (PPL); solution developed, organometallic bilayer where the imaging and masking layer have been combined into one material on top of a PPL; and finally silylated resists. They are examined in a very general form without regard to the specifics of chemistry of the variations within each group, but rather to what is common to each group and how that affects their effectiveness as candidates for a near term EUV resist. In particular they are examined with respect to sensitivity, potential resolution, optical density, etching selectivity during pattern transfer, and any issues associated with pattern fidelity such as swelling.
DOE
Extreme Ultraviolet Radiation; Organometallic Compounds; Refracting Telescopes; Optical Density; Imaging Techniques

19960045443 Lawrence Livermore National Lab., Livermore, CA USA
Large area damage testing of optics
Sheehan, Lynn, Lawrence Livermore National Lab., USA; Kozlowski, Mark, Lawrence Livermore National Lab., USA;

Stolz, Chris, Lawrence Livermore National Lab., USA; Genin, Francois, Lawrence Livermore National Lab., USA; Runkel, Mike, Lawrence Livermore National Lab., USA; Schwartz, Sheldon, Lawrence Livermore National Lab., USA; Hue, Jean, Centre d'Etudes de Limeil-Valenton, France; Apr. 26, 1996, 18p; In English; 2; International Symposium on Optical Systems Design and Production, 12-16 May 1996, Glasgow, UK

Contract(s)/Grant(s): W-7405-eng-48

Report No.(s): UCRL-JC-122006; CONF-9605182-2; DE96-010401; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The damage threshold specifications for the National Ignition Facility will include a mixture of standard small-area tests and new large-area tests. During our studies of laser damage and conditioning processes of various materials we have found that some damage morphologies are fairly small and this damage does not grow with further illumination. This type of damage might not be detrimental to the laser performance. We should therefore assume that some damage can be allowed on the optics, but decide on a maximum damage allowance of damage. A new specification of damage threshold termed 'functional damage threshold' was derived. Further correlation of damage size and type to system performance must be determined in order to use this measurement, but it is clear that it will be a large factor in the optics performance specifications. Large-area tests have verified that small-area testing is not always sufficient when the optic in question has defect-initiated damage. This was evident for example on sputtered polarizer and mirror coatings where the defect density was low enough that the features could be missed by standard small- area testing. For some materials, the scale-length at which damage non-uniformities occur will effect the comparison of small-area and large-area tests. An example of this was the sub-aperture tests on KD*P crystals on the Beamlet test station. The tests verified the large-area damage threshold to be similar to that found when testing a small-area. Implying that for this KD*P material, the dominate damage mechanism is of sufficiently small scale-length that small-area testing is capable of determining the threshold. The Beamlet test station experiments also demonstrated the use of on-line laser conditioning to increase the crystals damage threshold.

DOE

Laser Outputs; Functional Design Specifications; On-Line Systems; Laser Damage; Coatings

19960045628 Naval Postgraduate School, Monterey, CA USA

Integrated Optical Sigma-Delta Modulators

Ying, Stephen J., Naval Postgraduate School, USA; Sep. 1995, 53p; In English

Report No.(s): AD-A304251; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Modern avionics equipment, such as super resolution direction-finding systems, now require resolutions on the order of 20 to 22 bits. Over-sampled analog-to-digital converter architectures offer a means of exchanging resolution in time for that in amplitude and represent an attractive approach to implementing precision converters without the need for complex precision analog circuits. Using over-sampling techniques based on sigma-delta modulation, a convenient tradeoff exists between sampling rate and resolution. One of the major advantages of integrated optics is the capability to efficiently couple wideband signals into the optical domain. Typically, sigma-delta processors require simple and relatively low-precision analog components and thus are well suited to integrated optical implementations. This thesis reviews the current sigma-delta methodology, the advantages of optical integrated circuits and presents the design of a second-order, integrated optical sigma-delta modulator. Simulation results for both a first and second order architecture are presented by evaluating the transfer characteristics numerically. Design parameters such as limit cycles are quantified and explained. Performance issues and future efforts are also considered.

DTIC

Analog to Digital Converters; Avionics; Radio Direction Finders; Signal Processing; Computerized Simulation; Signal to Noise Ratios; Optical Waveguides; Delta Modulation; Architecture (Computers)

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19960042693 Sandia National Labs., Albuquerque, NM USA

Current initiation in low-density foam z-pinch plasmas

Derzon, M., Sandia National Labs., USA; Nash, T., Sandia National Labs., USA; Allshouse, G., Sandia National Labs., USA; Antolak, A., Sandia National Labs., USA; Deeney, C., Sandia National Labs., USA; Hurst, M., Sandia National Labs., USA; McGurn, J., Sandia National Labs., USA; Muron, D., Sandia National Labs., USA; Seaman, J., Sandia National Labs., USA; MacFarlane, J., Wisconsin Univ., USA; Demiris, T., Lawrence Livermore National Lab., USA; Hrubesh, L., Lawrence Livermore National Lab., USA; Ryutov, D., Lawrence Livermore National Lab., USA; Barber, T., Ktech Corp., USA; Gilliland, T., Ktech Corp., USA; Jobe, D., Ktech Corp., USA; Lazier, S., Ktech Corp., USA; [1996], 14p; In English; 11th; Topical Conference on High Temperature Plasma Diagnostics, 12-16 May 1996, Monterey, CA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-0605C; CONF-960543-17;

DE96-011697; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Low density agar and aerogel foams were tested as z-pinch loads on the SATURN accelerator. In these first experiments, we studied the initial plasma conditions by measuring the visible emission at early times with a framing camera and 1-D imaging. At later time, near the stagnation when the plasma is hotter, x-ray imaging and spectral diagnostics were used to characterize the plasma. Filamentation and arcing at the current contacts was observed. None of the implosions were uniform along the z-axis. The prime causes of these problems are believed to be the electrode contacts and the current return configuration and these are solvable. Periodic phenomena consistent with the formation of instabilities were observed on one shot, not on others, implying that there may be a way of controlling instabilities in the pinch. Many of the issues involving current initiation may be solvable. Solutions are discussed.

DOE

Zeta Pinch; Inertial Confinement Fusion; Low Density Materials; Foams; Aerogels; Plasma Currents

19960042709 Massachusetts Inst. of Tech., Plasma Fusion Center, Cambridge, MA USA

Massachusetts Institute of Technology, Plasma Fusion Center FY97--FY98 work proposal

Mar. 1996, 72p; In English

Contract(s)/Grant(s): DE-AC02-78ET-51013

Report No.(s): DOE/ET/51013-T249; DE96-010299; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Alcator C-Mod is the high-field, high-density divertor tokamak in the world fusion program. It is one of five divertor experiments capable of plasma currents exceeding one megamp. Because of its compact dimensions, Alcator C-Mod investigates an essential area in parameter space, which complements the world's larger experiments, in establishing the tokamak physics database. Three key areas of investigation have been called out in which Alcator C-Mod has a vital role to play: (1) divertor research on C-Mod takes advantage of the advanced divertor shaping, the very high scrap-off-layer power density, unique abilities in impurity diagnosis, and the High-Z metal wall, to advance the physics understanding of this critical topic; (2) in transport studies, C-Mod is making critical tests of both empirical scalings and theoretically based interpretations of tokamak transport, at dimensional parameters that are unique but dimensionless parameters often comparable to those in much larger experiments; (3) in the area of Advanced Tokamak research, so important to concept optimization, the high-field design of the device also provides long pulse length, compared to resistive skin time, which provides an outstanding opportunity to investigate the extent to which enhanced confinement and stability can be sustained in steady-state, using active profile control. In addition to these main programmatic emphasis, important enabling research is being performed in MHD stability and control, which has great significance for the immediate design of ITER, and in the physics and engineering of ICRF, which is the main auxiliary heating method on C-Mod.

DOE

Controlled Fusion; Tokamak Devices; Thermonuclear Reactions; Divertors (Fusion Reactors); Fusion Reactors

19960042730 Lawrence Livermore National Lab., Livermore, CA USA

Heavy ion fusion experiments at LLNL

Barnard, J. J., Lawrence Livermore National Lab., USA; Cable, M. D., Lawrence Livermore National Lab., USA; Callahan, D. A., Lawrence Livermore National Lab., USA; Deadrick, F. J., Lawrence Livermore National Lab., USA; Eylon, S., Lawrence Livermore National Lab., USA; Fessenden, T. J., Lawrence Livermore National Lab., USA; Friedman, A., Lawrence Livermore National Lab., USA; Grote, D. P., Lawrence Livermore National Lab., USA; Holm, K. A., Lawrence Livermore National Lab., USA; Hopkins, H. A., Lawrence Livermore National Lab., USA; Judd, D. L., Lawrence Livermore National Lab., USA; Hanks, R. L., Lawrence Livermore National Lab., USA; Hawkins, S. A., Lawrence Livermore National Lab., USA; Kirbie, H. C., Lawrence Livermore National Lab., USA; Logan, B. G., Lawrence Livermore National Lab., USA; Lund, S. M., Lawrence Livermore National Lab., USA; Nattrass, L. A., Lawrence Livermore National Lab., USA; Longinotti, D., Edgerton, Germeshausen and Grier, Inc., USA; Feb. 06, 1996, 14p; In English; 8th; International Committee for Future Accelerators (ICFA) Advanced Beam Dynamics Workshop on Space Charge Dominated Beams and Applications of High Brightness Beams, 11-13 Oct. 1995, Bloomington, IN, USA

Contract(s)/Grant(s): W-7405-eng-48; DE-AC03-76SF-00098

Report No.(s): UCRL-JC-122314; CONF-9510263-14; DE96-011003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We review the status of the experimental campaign being carried out at Lawrence Livermore National Laboratory, involving scaled investigations of the acceleration and transport of space-charge dominated heavy ion beams. The ultimate goal of these experiments is to help lay the groundwork for a larger scale ion driven inertial fusion reactor, the purpose of which is to produce inexpensive and clean electric power.

DOE

Heavy Ions; Inertial Confinement Fusion; Ion Beams; Particle Acceleration; Research

19960042864 Sandia National Labs., Albuquerque, NM USA

Pulsed power driven hohlraum research at Sandia National Laboratories

Leeper, R. J., Sandia National Labs., USA; Alberts, T. E., San-

dia National Labs., USA; Allshouse, G. A., Sandia National Labs., USA; [1996], 9p; In English; 11th; International Conference on High-Power Particle Beams, 10-14 Jun. 1996, Prague, Czech Republic
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-1153C; CONF-960610-2; DE96-011818; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Three pulsed power driven hohlraum concepts are being investigated at Sandia for application to inertial fusion research. These hohlraums are driven by intense proton and Li ion beams as well as by two different types of z-pinch x-ray sources. Research on these hohlraum systems will continue on Sandia's PBFA 2-Z facility.
DOE
X Ray Sources; Proton Beams; Hohlraums; Zeta Pinch

19960042872 Sandia National Labs., Albuquerque, NM USA
Design and analysis of the PBFA-Z vacuum insulator stack
Shoup, R. W., Sandia National Labs., USA; Long, F., Sandia National Labs., USA; Martin, T. H., Sandia National Labs., USA; [1996], 9p; In English; 11th; International Conference on High Power Particle Beams, 10- 4 Jun. 1996, Prague, Czech Republic
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-1229C; CONF-9606214-1; DE96-010539; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Sandia is developing PBFA-Z, a 20-MA driver for z-pinch experiments by replacing the water lines, insulator stack, and MITLs on PBFA 2 with new hardware. The design of the vacuum insulator stack was dictated by the drive voltage, the electric field stress and grading requirements, the water line and MITL interface requirements, and the machine operations and maintenance requirements. The insulator stack will consist of four separate modules, each of a different design because of different voltage drive and hardware interface requirements. The shape of the components in each module, i.e., grading rings, insulator rings, flux excluders, anode and cathode conductors, and the design of the water line and MITL interfaces, were optimized by using the electrostatic analysis codes, ELECTRO and JASON. The time dependent performance of the insulator stack was evaluated using IVORY, a 2-D PIC code. This paper will describe the insulator stack design and present the results of the ELECTRO and IVORY analyses.
DOE
Electric Potential; Electrostatics; Electric Fields; Insulators; Zeta Pinch; Conductors

19960042892 Argonne National Lab., IL USA
Thermal ablation of plasma-facing surfaces in tokamak disruptions: Sensitivity to particle kinetic energy
Ehst, David A., Argonne National Lab., USA; Hassanein, Ahmed, Argonne National Lab., USA; Feb. 1996, 31p; In English
Contract(s)/Grant(s): W-31109-eng-38
Report No.(s): ANL/FPP/TM-289; DE96-008355; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ablation damage to solid targets with high heat flux impulses is generally greater high-energy electron beam heat sources compared to low-energy plasma guns. This sensitivity to incoming particle kinetic energy is explored with computer modelling; a fast-running routine (DESIRE) is developed for initial scoping analysis and is found to be in reasonable agreement with several experiments on graphite and tungsten targets. If tokamak disruptions are characterized by particle energies less than (approximately)1 keV, then we expect plasma guns are a better analogue than electron beams for simulating disruption behavior and testing candidate plasma-facing materials.
DOE
Tokamak Devices; Thermal Plasmas; Plasmas (Physics); Plasma Guns; Heat Flux; Electron Beams

19960042913 Ecole Polytechnique Federale de Lausanne, Centre De Recherches en Physique des Plasmas., Switzerland
Three-dimensional model of plasma equilibrium based on poloidal representation of magnetic field
Cooper, W. A., Ecole Polytechnique Federale de Lausanne, Switzerland; Gruber, R., Centro Svizzero di Calcolo Scientifio, Switzerland; Degtyarev, L. M., Academy of Sciences (USSR), USSR; Martynov, A. A., Academy of Sciences (USSR), USSR; Medvedev, S. Yu., Academy of Sciences (USSR), USSR; Shafranov, V. D., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Dec. 1995, 22p; In English
Report No.(s): LRP-534/95; DE96-619999; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The equations of three-dimensional plasma equilibrium based on the magnetic field representation with poloidal magnetic flux (Psi) and plasma current F are formulated. As a result, the description of three-dimensional equilibrium configurations is obtained as a system of the following equations: an elliptic type equation for the poloidal flux, a magnetic differential equation (MDE) for the poloidal current and the equations for the 'base' vector field b. For the resolution of the difficulties with possible singular solutions of the MDE on the rational toroidal magnetic surfaces small regularizing terms are introduced into the proposed system of equations. Second order differential terms with a small parameter are added to the MDE transforming it to an elliptic type equation. Several variants of such a regularization are proposed. The system of equations formulated can serve as a basis for a numerical code

development of three-dimensional equilibrium calculations with island structures.
DOE
Magnetic Flux; Magnetic Fields; Poloidal Flux; Elliptic Differential Equations; Plasma Equilibrium; Plasma Currents

19960042914 Ecole Polytechnique Federale de Lausanne, Switzerland
Effects of electron-cyclotron instabilities on gyrotron beam quality
Jost, G., Ecole Polytechnique Federale de Lausanne, Switzerland; Tran, T. M., Ecole Polytechnique Federale de Lausanne, Switzerland; Appert, K., Ecole Polytechnique Federale de Lausanne, Switzerland; Wuethrich, S., Cray Research Switzerland S.A., Switzerland; Feb. 1996, 21p; In English
Report No.(s): LRP-536/96; DE96-621886; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A two-dimensional PIC code aimed at the investigation of electron-cyclotron beam instabilities in gyrotrons and their effects on the beam quality is presented. The code is based on recently developed techniques for handling charge conservation and open boundaries. It has been implemented on the massively parallel computer CRAY T3D. First results show an electromagnetic backward instability periodically growing and decaying to energy levels close to those obtained from the electrostatic Bernstein wave instability. On the average, the resulting beam degradation is 3 to 4 times larger than that predicted by electrostatic models.
Author (DOE)
Cyclotron Resonance Devices; Massively Parallel Processors; Magnetohydrodynamic Stability; Computerized Simulation; Electron Beams; Electrostatic Waves; Two Dimensional Models

19960042915 Ecole Polytechnique Federale de Lausanne, Centre de Recherche en Physique des Plasma., Switzerland
The effect of partial poloidal wall sections on the wall stabilization of external kink modes
Ward, D. J., Ecole Polytechnique Federale de Lausanne, Switzerland; Feb. 1996, 39p; In English
Report No.(s): LRP-538/96; DE96-621887; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An analysis of the effect on the wall stabilization of external kink modes due to toroidally continuous gaps in the resistive wall is performed. The effects with and without toroidal rotation are studied. For a high-(beta) equilibrium, the mode structure is localized on the outboard side. Therefore, outboard gaps greatly increase the growth rate when there is no rotation. For resistive wall stabilization by toroidal rotation, the presence of gaps has the same effect as moving the wall farther away, i.e. destabilizing for the ideal plasma mode, and stabilizing for the resistive wall mode. The region of stability, in terms of wall position, is reduced in size and moved closer to the plasma. However, complete stabilization becomes possible at considerably reduced rotation frequencies. For a high-(beta), reverse-shear equilibrium both the resistive wall mode and the ideal plasma mode can be stabilized by close fitting discrete passive plates on the outboard side. The necessary toroidal rotation frequency to stabilize the resistive wall mode using these plates is reduced by a factor of three compared to that for a poloidally continuous and complete wall at the same plasma-wall separation.
Author (DOE)
Plasma Equilibrium; Wall Pressure; Tokamak Devices; Rotating Plasmas; Equilibrium Flow; Stabilization; Toroidal Plasmas

19960042916 Max-Planck-Inst. fuer Plasmaphysik, Garching, Germany
H(alpha) spectroscopy and limiter calorimetry in W7-AS
Das, J., Max-Planck-Inst. fuer Plasmaphysik, Germany; Sep. 1995, 18p; In English
Report No.(s): IPPIII-204; DE96-740675; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

This report describes the H(sub (alpha)) and limiter calorimetry diagnostics in W7-AS. A short description of the experiment is followed by details of the experimental apparatus and finally by the results of the investigations.
DOE
Heat Measurement; H Alpha Line; Limiters (Fusion Reactors); Stellarators; Balmer Series; Absorption Spectra; Temperature Gradients; Plasma Physics; Visible Spectrum

19960042929 National Inst. for Fusion Science, Nagoya, Japan
A new variable transformation technique for the nonlinear drift vortex
Orito, K., Editor, National Inst. for Fusion Science, Japan; Feb. 1996; ISSN 0915-633X, 16p; In English
Report No.(s): NIFS-403; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The dipole vortex solution of the Hasegawa-Mima equation describing the nonlinear drift wave is a stable solitary wave which is called the modon. The profile of the modon depends on the nonlinearity of the E x B drift. In order to investigate the nonlinear drift wave more accurately, the effect of the polarization drift needs to be considered. In the case of containing the effect of the polarization drift, the profile of the electrostatic potential is distorted in the direction perpendicular to the E x B drift.
Author
Solitary Waves; Vortices; Plasma Waves; Nonlinearity; Plasma Drift; Computational Fluid Dynamics

19960042952 National Inst. for Fusion Science, Nagoya Japan

Studies on D-(3)He Fusion in LHD

Iiyoshi, A., National Inst. for Fusion Science, Japan; Fujiwara, M., National Inst. for Fusion Science, Japan; Okamoto, M., National Inst. for Fusion Science, Japan; Ohyabu, N., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Sasao, M., National Inst. for Fusion Science, Japan; Sudo, S., National Inst. for Fusion Science, Japan; Kanno, R., National Inst. for Fusion Science, Japan; Mutoh, T., National Inst. for Fusion Science, Japan; Murakami, S., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Tomita, Y., National Inst. for Fusion Science, Japan; Yamazaki, K., National Inst. for Fusion Science, Japan; Mar. 1996; ISSN 0915-6372, 112p; In Mixed; In Japanese; In English

Report No.(s): NIFS-MEMO-21; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Where LHD (Large Helical Device) studies on D-D fusion burning have been carried out, tritium burning has not been included. We propose experiments on D-(3)He fusion in the LHD. This fueled fusion has the reaction cross-section as large as D-D fusion, however the production rate of neutrons is quite low compared with other fueled fusions. This low production rate of neutrons mitigate limitations on experiments. Up to now, D-T burning with fusion output of 1 to approximately 10 MW has been studied experimentally in TFTR and JET; however, fusion produced neutrons restricted to physically detailed experiments in a short pulse operation. D-(3)He burning experiments with about 0.1 to approximately 1 MW fusion output in LHD promote the burning physics because there are no limitations on the experiments and these may take the lead in performance of the steady and clean fusion. In this paper, we report the results on the D-(3)He fusion plan in LHD. In the first section, the significance of these experiments and the basic data of D-(3)He fueled fusion are presented. In Sections 2 and 3 the theoretical studies as well as the experimental plan in LHD are presented. In Section 4 the development of a high energy beam source is discussed. In Section 5 a D-(3)He steady burning in LHD is studied. In Section 6 we summarize and discuss the results of this plan. This plan is the first step of D-(3)He fusion experiments and hereafter the innovative ideas may enrich this plan.

Author (revised)

Tritium; Particle Production; Deuterium; Fusion Reactors; Impact Fusion

19960042962 Technical Research Centre of Finland, Espoo, Finland

Finnish Fusion Research Programme Yearbook 1993-1994

Karttunen, Seppo, Editor, Technical Research Centre of Finland, Finland; Paettikangas, Timo, Technical Research Centre of Finland, Finland; May 15, 1995, 96p; In English

Report No.(s): VTT-FFUSION-R95/1; DE96-615384; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Finnish Fusion Research Programme (FFUSION) is one of the national energy research programmes funded by the Ministry of Trade and Industry and from 1995 by TEKES. National organization for fusion research is necessary for efficient and successful participation in international fusion programmes. FFUSION programme serves well for this purpose and it made possible to establish relations and the dialogue with the European Fusion Programme. The process led to the Finnish Association Euratom-TEKES in early 1995. The first period of the FFUSION programme (1993-1994) was preparation for the association to the Community Programme. The strategy was to emphasize fusion technology parallel with the basic fusion and plasma physics and to activate the related Finnish industry to collaborate and participate in the FFUSION programme and later in the European Fusion Programme. The key element in the strategy is the focusing our fairly small R and D effort to a few topics, which increases possibilities to be competitive in Europe. The physics programme in FFUSION deals mainly with theoretical and computational studies of radio-frequency heating in tokamak plasmas. Technology programme started with prestudies in 1993 and it concentrates into two areas: fusion reactor materials and remote handling systems.

DOE

Nuclear Fusion; Fusion Reactors; Tokamak Devices; Plasma Heating; Plasma Physics

19960042990 National Inst. for Fusion Science, Theory and Computer Simulation Center., Nagoya, Japan

Multi-scale semi-ideal magnetohydrodynamics of a tokamak plasma

Bazdenkov, Sergey, National Inst. for Fusion Science, Japan; Sato, Tetsuya, National Inst. for Fusion Science, Japan; Watanabe, Kunihiko, National Inst. for Fusion Science, Japan; Horiuchi, R., National Inst. for Fusion Science, Japan; Hayashi, T., National Inst. for Fusion Science, Japan; Todo, Y., National Inst. for Fusion Science, Japan; Kageyama, A., National Inst. for Fusion Science, Japan; Watanabe, T. H., National Inst. for Fusion Science, Japan; Takamaru, H., National Inst. for Fusion Science, Japan; Sep. 1995, 28p; In English

Report No.(s): NIFS-376; DE96-742077; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An analytical model of fast spatial flattening of the toroidal current density and q-profile at the nonlinear stage of (m = 1/n = 1) kink instability of a tokamak plasma is presented. The flattening is shown to be an essentially multi-scale phenomenon which is characterized by, at least, two magnetic Reynolds numbers. The ordinary one, R(sub m), is related with a characteristic radial scale-length, while the other, R(sub m)(sup *), corresponds to a characteristic scale-length of plasma inhomogeneity along the magnetic field line. In a

highly conducting plasma inside the q = 1 magnetic surface, where q value does not much differ from unity, plasma evolution is governed by a multi-scale non-ideal dynamics characterized by two well-separated magnetic Reynolds numbers, R(sub m) and R(sub m)(sup *) (identical to) (1 - q) R(sub m), where R(sub m)(sup *) - O(1) and R(sub m) is greater than 1. This dynamics consistently explains two seemingly contradictory features recently observed in a numerical simulation [Watanabe et al., 1995]: (1) the current profile (q-profile) is flattened in the magnetohydrodynamic time scale within the q = 1 rational surface; (2) the magnetic surface keeps its initial circular shape during this evolution.
Author (DOE)
Magnetohydrodynamic Stability; Tokamak Devices; Current Density; Magnetic Fields; Reynolds Number; Nonequilibrium Plasmas

19960043000 Ecole Polytechnique Federale de Lausanne, Switzerland
Measurement of the parallel velocity distribution function of the electron beam in a quasi-optical gyrotron by electron cyclotron emission
Soumagne, G., Ecole Polytechnique Federale de Lausanne, Switzerland; Alberti, S., Ecole Polytechnique Federale de Lausanne, Switzerland; Hogge, J. P., Ecole Polytechnique Federale de Lausanne, Switzerland; Pedrozzi, M., Ecole Polytechnique Federale de Lausanne, Switzerland; Siegrist, M. R., Ecole Polytechnique Federale de Lausanne, Switzerland; Tran, M. Q., Ecole Polytechnique Federale de Lausanne, Switzerland; Tran, T. M., Ecole Polytechnique Federale de Lausanne, Switzerland; Mar. 1996, 25p; In English
Report No.(s): LRP-543/96; DE96-621865; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The parallel velocity distribution function of the weakly relativistic electron beam of a quasi-optical gyrotron (QOG) has been determined by measuring the Doppler-shifted Electron Cyclotron Emission (ECE) at an angle (theta)=15(sup o) with respect to the external magnetic DC-field. Due to the Doppler shift, the frequency of the spontaneous cyclotron emission at the fundamental ((nu)(sub 0)=100 GHz) is upshifted to 140 GHz. A broadening of the spectrum up to 10 GHz (Full Width at Half Maximum FWHM) was measured. The measured mean frequency agrees well with the theoretical predictions, but the observed line-width, and hence the parallel velocity distribution function, is 2-3 times larger than expected. Considerations on ECE-measurements of the electron beam energy spread, performed at larger angles (theta), are also discussed.
Author (DOE)
Cyclotron Radiation; Relativistic Electron Beams; Magnetic Fields; Doppler Effect; Velocity Measurement; Microwave Amplifiers; Plasma Diagnostics; Cyclotron Resonance Devices

19960043016 National Inst. for Fusion Science, Nagoya, Japan
Experiments of an intense H(sup -) ion beam acceleration
Ando, A., National Inst. for Fusion Science, Japan; Takeiri, Y., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Oka, Y., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Asano, E., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Kuroda, T., National Inst. for Fusion Science, Japan; Aug. 1995, 37p; In English
Report No.(s): NIFS-369; DE96-742078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An intense H(sup -) beam of a single beamlet is extracted from a large multicusp plasma source operated with cesium seeding. The H(sup -) beams are accelerated up to 100keV by a single-stage or a two-stage electrode system. Spatial profiles of the beams are measured calorimetrically and a minimum beam divergence angle of 5mrad is achieved at a H(sup -) current density of 30mA/cm(sup 2) with a beam energy of 100keV. A ratio of an acceleration current to a H(sup -) current increases abruptly when a H(sup -) current saturates in the space charge limited region. This enhancement is mainly due to secondary electrons caused by the intersection of H(sup -) beams with an extraction grid. When an operating gas pressure decreases, the ratio of the acceleration current to the H(sup -) current decreases. This is related to a stripping loss of H(sup -) ions in the electrodes. A beam divergence angle becomes minimum when a ratio of V(sub acc) to V(sub ext) is set at a optimum value of 1.6 in the single-stage acceleration. This ratio is almost the same as that in the double-stage acceleration, where the optimum ratio of E(sub acc1)/E(sub ext) is 1.5. In the optimum E(sub acc1)/E(sub ext) ratio the divergence angle is not affected by V(sub acc2). The divergence angle can be reduced by changing V(sub acc2) even if the ratio of E(sub acc1)/E(sub ext) is not optimized. The beam steering effect by permanent magnets buried in an extraction grid is observed in nine beamlets experiments. A simple calculation of a single particle trajectory gives a good approximation of the beam deflection angle.
Author (DOE)
Particle Trajectories; Permanent Magnets; Ion Beams; Atomic Beams; Beam Injection; Pressure Ratio; Plasmas (Physics); Hydrogen Ions; Heat Measurement

19960043022 National Inst. for Fusion Science, Nagoya, Japan
Development of diagnostic beams for alpha particle measurement on ITER
Sasao, M., National Inst. for Fusion Science, Japan; Taniike, A., National Inst. for Fusion Science, Japan; Nomura, I., National Inst. for Fusion Science, Japan; Wada, M., Doshisha Univ., Japan; Yamaoka, H., Institute of Physical and Chemi-

cal Research, Japan; Sato, M., Himeji Technical Univ., Japan; Aug. 1995, 26p; In English
Report No.(s): NIFS-370; DE96-742075; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The feasibility of alpha particle measurement using a high energy diagnostic beam in combination with a neutral particle analyzer is examined for a burning plasma on ITER. In order to measure them in the energy range of 0.5 - 3.5 MeV, the required beam energy is around 1 MeV for a (sup 3)He(sup 0) beam and 3 MeV for a (sup 6)Li(sup 0) beam with the beam current density of around 1 mA/cm(sup 2) for both cases. Among the various methods to produce such a high energy neutral beam, the acceleration of negative ions is most favorable. Recent results of relatively small-scale experiments on these negative ion sources show that the required current density is now realistic. Some technical problems how to scale-up the ion sources to be used on an ITER-size experiment are also studied on these experiments.
Author (DOE)
Alpha Particles; Beam Currents; Fusion Reactors; Ion Sources; Current Density; Ion Probes; Negative Ions; Plasma Diagnostics

19960043032 Lawrence Livermore National Lab., Livermore, CA USA
Molecular gas electron distribution function with space and time variation
Garcia, Manuel, Lawrence Livermore National Lab., USA; May 01, 1995, 38p; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): UCRL-ID-121161; DE96-012249; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The desire for improved control over electric discharge phenomena in a wide variety of scientific, technological, manufacturing, and waste processing activities spurs the development of non-equilibrium, non-uniform, and time dependent models. This paper addresses the situation of a slightly ionized, uniform gas with a space and time varying electric field, and in which inelastic collisions occur. The purpose here is to present a reasonably consistent, and reasonably accessible analytical result for the electron kinetics in a gas discharge regime of technological interest. This paper will be structured as follows. First, the analytical result for the logarithmic derivative in energy of the electron distribution function is state. Then, a discussion of the derivation is given. Examples of the solution are shown for an idealized nitrogen-like gas where a uniform electric field ramps in time between static conditions, and then for sinusoidal behavior. Further examples show the effect of a static electric field that decays exponentially with distance. Finally, the combined effect of field gradients in space and time is demonstrated by mapping out the average electron energy in the model gas for a field with sinusoidal temporal variation and exponential spatial decay.
DOE
Ionized Gases; Temporal Distribution; Time Dependence; Electric Discharges; Electric Fields; Electron Energy; Molecular Gases

19960043033 Lawrence Livermore National Lab., Livermore, CA USA
Use of thin wall imaging in the diagnosis of laser heated hohlraums
Suter, L. J., Lawrence Livermore National Lab., USA; Thiessen, A. R., Lawrence Livermore National Lab., USA; Ze, F., Lawrence Livermore National Lab., USA; Kauffman, R., Lawrence Livermore National Lab., USA; Price, R. H., Lawrence Livermore National Lab., USA; Rupert, V. C., Lawrence Livermore National Lab., USA; Slivinsky, V. W., Lawrence Livermore National Lab., USA; Wang, C., Lawrence Livermore National Lab., USA; May 14, 1996, 22p; In English; 11; Annual High-temperature Plasma Diagnostics Conference, 12 - 16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-116323; CONF-960543-15; DE96-012232; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-Z, laser heated hohlraums can be made thick enough to contain thermal radiation, yet thin enough to let out x-rays greater than (approximately) 6keV produced by hot, relatively dense blow-off plasma. The authors use such 'thin wall hohlraums' to observe the physical location of hot, dense, laser produced hohlraum plasmas. This technique has allowed them to come to some understanding of laser transport/deposition, plasma stagnation and bulk plasma filling.
DOE
Laser Deposition; Dense Plasmas; X Rays; Thin Walls; Hohlraums

19960043041 Lawrence Livermore National Lab., Livermore, CA USA
Smoothing by spectral dispersion using random phase modulation for inertial confinement fusion
Rothenberg, J. E., Lawrence Livermore National Lab., USA; Nov. 15, 1995, 12p; In English; 16th; 6th; Annual Conference on Lasers and Electro-Optics, 2-7 Jun. 1996, Anaheim, CA, Anaheim, CA, USA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-122668; CONF-960642-10; DE96-007556; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical simulations of beam smoothing using random phase modulation and grating dispersion are presented. Spatial spectra of the target illumination show that significantly

improved smoothing at low spatial frequency is achieved while maintaining uniform intensity in the laser amplifier.
DOE
Inertial Confinement Fusion; Phase Modulation; Smoothing; Glass Lasers; High Power Lasers; Laser Fusion

19960043046 Ecole Polytechnique Federale de Lausanne, Centre De Recherches en Physique des Plasmas., Switzerland
On locating the poloidal field coils for tokamak vertical position control
Lister, J. B., Ecole Polytechnique Federale de Lausanne, Switzerland; Martin, Y., Ecole Polytechnique Federale de Lausanne, Switzerland; Moret, J. M., Ecole Polytechnique Federale de Lausanne, Switzerland; Dec. 1995, 33p; In English
Report No.(s): LRP-533/95; DE96-619968; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The TCV tokamak has 16 poloidal field coils for plasma shaping, distributed around the vacuum vessel. Experiments are described which determine the relative merits of the different coil positions for controlling the unstable vertical movement of elongated plasmas. The results show over an order of magnitude variation in the amplitude of the plasma vertical position response to voltages applied to the different coils. The currents induced in the vessel, the required reactive feedback power and the ohmic power dissipated in the vessel all depend strongly on the coil location. Coils on the inboard, small major radius, side of the vacuum vessel are particularly effective at producing fast vertical displacements. Comparing the results of two separate experiments with the predictions of the rigid current displacement model shows that the relative merits of the different coil positions are adequately explained by this model.
DOE
Terminal Configured Vehicle Program; Plasmas (Physics); Feedback; Field Coils; Electric Potential

19960043049 National Inst. for Fusion Science, Nagoya, Japan
A new cable-in-conduit conductor magnet with insulated strands
Yamaguchi, Satarou, National Inst. for Fusion Science, Japan; Yamamoto, Junya, National Inst. for Fusion Science, Japan; Motojima, Osamu, National Inst. for Fusion Science, Japan; Sep. 1995, 24p; In English
Report No.(s): NIFS-371; DE96-742076; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many studies have used cable-in-conduit conductor (CICC) coils in trying to develop an AC superconducting magnet because of its enormous potential if AC losses were low and insulation voltage was high. The strands in the most recent CICC magnets are coated with chromium or another metal with high electrical resistance to order to induce current re-distribution among the strands and to avoid a quench caused by a current imbalance. Current re-distribution is highly complex and very difficult to analyze because the conditions of the strand surfaces and the contact areas vary greatly with the operation of the conductor. If, however, the cable currents were well-balanced, insulating the strands would be the best way to reduce AC losses. We propose a new CICC magnet structure featuring a current lead that balances the strand currents via its resistance. Having calculated current balances, we find that strand currents are well within the present parameters for nuclear fusion experiments and superconducting magnet energy storages.
DOE
Alternating Current; Superconducting Magnets; Electrical Resistance; Current Distribution; Nuclear Fusion; Insulation

19960044440 Canadian Fusion Fuels Technology Project, Mississauga, Ontario Canada
ITER task T49 (1994): Hitex demonstration test
Miller, J., Atomic Energy of Canada Ltd., Canada; Rodrigo, L., Atomic Energy of Canada Ltd., Canada; Sood, S., Institut de Recherche de l'Hydro-Ontario, Canada; Fong, C., Institut de Recherche de l'Hydro-Ontario, Canada; Giereszewski, P., Canadian Fusion Fuels Technology Project, Canada; Jan. 1995, 29p; In English
Report No.(s): CFFTP-G-9503; DE96-615579; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The HITEX process has been proposed for detritiating impurities in the ITER plasma exhaust. It is based on isotopically exchanging the tritium bound in the impurities with protium, with the resulting HT extracted across a permeator. The process does not produce tritiated waste or tritiated water, and can achieve high decontamination factors with conventional equipment. A fully tritium-compatible loop was constructed at AECL Chalk River laboratories in order to demonstrate high-DF, and to further explore and optimize the operating conditions for HITEX for ITER plasma exhaust processing. The loop has a 15 L tank, a Pt-on-alumina isotope exchange reactor, and a commercial PdAg permeator. It can operate over 0-5 L/min recirculation rate, and with up to 10 Ci tritium. the initial tests focussed on detritiating CT(sub 4), and demonstrated that HITEX could achieve DF (approx) 10(exp 6). Test variables include the H2 swamping ratio, gas recirculation rate, initial tritium level, and gas composition. For DFs up to 10(exp 5), the experimental results are roughly consistent with a simple model based on complete mixing and complete equilibration. At DFs over 10(exp 5), the rate of decontamination slows down. The source of this slowdown needs to be confirmed. A two stage HITEX concept has been developed. The first stage is a once-through mode,to provide a factor of 10 DF. The second stage operates in a batch mode, to provide the remaining 10(exp 5) DF. An ITER 2-stage HITEX system processing 8.4 mol/hr impurities would provide 10(exp 6) DF on the waste stream, and 230 mol/hr Q(sup 2) product, at

about 5 g tritium inventory. Further tests on the HITEX tritium loop should study the effect of other experimental parameters, and identify the source of the slow tritium release. A 2-stage HITEX loop similar to the proposed ITER design should be built and tested.
DOE
Decontamination; Hydrogen; Plasmas (Physics); Tritium; Thermonuclear Reactions; Isotope Separation; Impurities; Fusion Reactors

19960044456 National Science Center, Kharkov, Ukraine
The becoming of nonlinear electromagnetic dissipative structure in nonequilibrium dissipative medium *Stanovlenie nelinejnykh ehlektromagnitnykh dissipativnykh struktur v neravnovesnykh provodyashchikh sredakh.*
Buts, A. V., National Science Center, Ukraine; Vodyanitskij, A. A., National Science Center, Ukraine; 1995, 39p; In Russian
Report No.(s): KFTI-95-7; DE96-618662; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The evolution of nonlinear electromagnetic and thermo-electromagnetic structure in a conducting medium under non-equilibrium condition is considered. This evolution can result in anomalous penetration of electromagnetic energy trough a conducting medium. The review of stationary nonequilibrium states on which ground such structures can form is done. The induction equation, which is describing the processes of electromagnetic structures becoming are obtained in electron magnetic hydrodynamic approximation. The solution of this equation is obtained in 1-D case when electric or magnetic field or incident electromagnetic wave field is given on the conducting medium surface. Incident electromagnetic wave forms magnetic shock wave, which percolates trough conducting medium until incident wave feeds it by energy. In the case of incident electromagnetic field has a pulse form the comparison of efficiency of linear and nonlinear penetration is done.
DOE
Electromagnetic Fields; Magnetohydrodynamics; Nonequilibrium Conditions; Nonlinearity; Plasma Heating

19960044465 Los Alamos National Lab., NM USA
Time resolved side scatter diagnostics at NOVA
Kyrala, G. A., Los Alamos National Lab., USA; Evans, S. C., Los Alamos National Lab., USA; Jimerson, J. R., Los Alamos National Lab., USA; Fernandez, J. C., Los Alamos National Lab., USA; [1996], 6p; In English; 11th; High Temperature Plasma Diagnostic Conference, 13-17 Jun. 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-96-1652; CONF-9606208-9; DE96-011274; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Side scattering of the radiation during the interaction of a laser beam with the long scale length plasma in hohlraum is a difficult problem of relevance to the viability of ICF. It is important to measure the absolute amount of the laser side scatter as well as the angular distribution of that scatter. The OSA diagnostics has been implemented on NOVA to measure these quantities. We have implemented a fiber-optically coupled streak camera to measure the temporally and angularly resolved side scatter radiation at 351 nm at 9 different angles. Filtered PIN diodes were positioned at 31 various angles in the E-field plane and B-field plane of the incident probe beam to sample and measure the scattered radiation at the 351 nm wavelength of the probe. The diode data was used to calibrate the Brillouin power received by the 9 strategically located fiber optic channels. This presentation will describe the OSA and associated diagnostics.
DOE
Angular Distribution; Fiber Optics; Hohlraums; P-I-N Junctions; Streak Cameras; Laser Beams; Plasma Diagnostics; Light (Visible Radiation); Brillouin Effect

19960044473 Forschungszentrum Karlsruhe G.m.b.H., Inst. fuer Materialforschung., Karlsruhe, Germany
Proceedings of the IEA-Technical Workshop on the Test Cell System for an International Fusion Materials Irradiation Facility. IEA-Implementing agreement for a programme of research and development on fusion materials
Moeslang, A., Editor, Forschungszentrum Karlsruhe G.m.b.H., Germany; Lindau, R., Editor, Forschungszentrum Karlsruhe G.m.b.H., Germany; Sep. 1995; ISSN 0947-8620, 413p; In English; IEA-Technical Workshop on the Test Cell System for an International Fusion Materials Irradiation Facility, 3-6 Jul. 1995, Karlsruhe, Germany
Report No.(s): FZKA-5633; CONF-9507229; DE96-740819; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche; US Sales Only; US Sales Only

After a Conceptual Design Activity (CDA) study on an International Fusion Material Irradiation Facility (IFMIF) has been launched under the auspices of the IEA, working groups and relevant tasks have been defined and agreed in an IEA-workshop that was held September 26-29 1994 at Karlsruhe. For the Test Cell System 11 tasks were identified which can be grouped into the three major fields neutronics, test matrix/users and test cell engineering. In order to discuss recently achieved results and to coordinate necessary activities for an effective design integration, a technical workshop on the Test Cell System was initiated. This workshop was organized on July 3-6 1995 by the Institute for Materials Research I at the Forschungszentrum Karlsruhe and attended by 20 specialists working in the fields neutronics, fusion materials R and D and test cell engineering in the European Union, Japan, and the USA of America. The presentations and discussions during this workshop have shown together with the elaborated lists of action items, that has been achieved in all three fields, and

that from the future IFMIF experimental program for a number of materials a database covering widerspread loading conditions up to DEMO-reactor relevant end-of-life damage levels can be expected.
DOE
Irradiation; Conferences; Flux (Rate); Neutron Emission

19960044475 Forschungszentrum Karlsruhe G.m.b.H., Karlsruhe, Germany
Neutron induced displacement damage in beryllium in the blanket of a (d,t)-fusion reactor ***Neutroneninduzierte Verlagerungsschaedigung von Beryllium im Blanket eines (d,t)-Fusionsreaktors***
Hermanutz, D., Forschungszentrum Karlsruhe G.m.b.H., Germany; Sep. 1995; ISSN 0947-8620, 114p; In German
Report No.(s): FZKA-5642; DE96-740681; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

Beryllium is a favored candidate for a neutron multiplier in solid breeder blankets of fusion reactors. This is mainly due to its low (n, 2n)-reaction threshold and because of its good thermal and mechanical properties. Its behaviour under intense neutron irradiation, however, is a crucial issue for its use in future fusion reactors. Displacement damage in beryllium so far has been calculated both with data related and methodological deficiencies. First of all, there is a need to have accurate cross-section data in order to obtain reliable spectra of primary knock-on atoms (PKA's). Furthermore, there are principal restrictions of the NRT-model in general used to calculate secondary displacements initiated by PKA's. The underlying theory of damage-energy (part of kinetic energy of PKA transferred elastically to matrix atoms) according to Lindhard is strictly valid only for medium and heavy mass ions with moderate energies in targets of the same element. In this work improved damage cross-sections and displacement rates (dpa/s) in beryllium have been calculated based on cross-section data from ENDF/B-6 (with a significantly improved (n, 2n)-evaluation) and on an appropriate treatment of damage-energy that is suitable for fusion relevant damage of light mass materials. 'This work has been performed in the framework of the Nuclear Fusion Project of the Forschungszentrum Karlsruhe and is supported by the European Communities within the European Fusion Technology Program'.
DOE
Blankets (Fusion Reactors); Breeder Reactors; Fusion Reactors; Nuclear Fusion; Heavy Ions

19960044508 Sandia National Labs., Albuquerque, NM USA
Spectroscopic diagnosis of foam z-pinch plasmas on SATURN
Nash, T. J., Sandia National Labs., USA; Derzon, M. S., Sandia National Labs., USA; Allshouse, G., Sandia National Labs., USA; Deeney, C., Sandia National Labs., USA; Jobe, D., Sandia National Labs., USA; McGurn, J., Sandia National Labs., USA; MacFarlane, J. J., Wisconsin Univ., USA; Wang, P., Wisconsin Univ., USA; [1996], 19p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-1290C; CONF-960543-1; DE96-010986; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solid and annular silicon aerogel and agar foams were shot on the accelerator SATURN to study plasma initiation, acceleration, and stagnation. SATURN delivers 7 MA with a 50 nsec rise time to these foam loads. We fielded several spectroscopic diagnostics to measure plasma parameters throughout the z-pinch discharge. A spatially resolved single frame time-gated EUV spectrometer measured the extent of plasma ablation off the surface foam. A time integrated crystal spectrometer showed that characteristic K shell radiation of silicon in the aerogel and of S and Na impurities in the agar were all attenuated when the foam loads were coated with a conductive layer of gold. The time resolved pinhole camera showed that in general the quality of the pinch implosions was poor but improved with increasing efforts to improve current continuity such as prepulse and conductive coatings.
DOE
Plasma Acceleration; Protective Coatings; Plasma Diagnostics; Aerogels; Zeta Pinch; Plasmas (Physics)

19960044511 Pacific Northwest Lab., Richland, WA USA
BEATRIX-2, phase 2: Data summary report
Slagle, O. D., Pacific Northwest Lab., USA; Hollenberg, G. W., Pacific Northwest Lab., USA; May 1996, 136p; In English
Contract(s)/Grant(s): DE-AC06-76RL-01830
Report No.(s): PNNL-11148; DE96-011596; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The BEATRIX-2 experimental program was an International Energy Agency sponsored collaborative effort between Japan, Canada, and the USA to evaluate the performance of ceramic solid breeder materials in a fast-neutron environment at high burnup levels. This report addresses the Phase 2 activities, which included two in situ tritium-recovery canisters: temperature-change and temperature-gradient. The temperature-change canister contained a Li2O ring specimen that had a nearly uniform temperature profile and was capable of temperature changes between 530 and 640 C. The temperature-gradient canister contained a Li2ZrO3 pebble bed operating under a thermal gradient of 440 to 1100 C. Postirradiation examination was carried out to characterize the Phase 2 in situ specimens and a series of nonvented capsules designed to address the compatibility of beryllium with lithium-ceramic solid-breeder materials. The results of the BEATRIX-2, Phase 2, irradiation experiment provided an extensive data base on

the in situ tritium-release characteristics of Li2O and Li2ZrO3 for lithium burnups near 5%. The composition of the sweep gas was found to be a critical parameter in the recovery of tritium from both Li2O and Li2ZrO3. Tritium inventories measured confirmed that Li2O and Li2ZrO3 exhibited very low tritium retention during the Phase 2 irradiation. Tritium inventories in Li2ZrO3 after Phase 2 tended to be larger than those found for Li2ZrO3 in other in situ experiments, but the larger values may reflect the larger generation rates in BEATRIX-2. A series of 20 capsules was irradiated to determine the compatibility of lithium ceramics and beryllium under conditions similar to a fusion blanket. It is concluded that Li2O and Li2ZrO3 should remain leading candidates for use in a solid-breeder fusion-blanket application.
DOE
Aluminum Oxides; Ceramics; Lithium Isotopes; Tritium; Temperature Gradients; Irradiation; Beryllium

19960044521 Wisconsin Univ., Dept. of Nuclear Engineering and Engineering Physics., Madison, WI USA
Evolution of toroidal flow during, after mode locking
Yokoyama, M., Wisconsin Univ., USA; Callen, J. D., Wisconsin Univ., USA; Hegna, C. C., Wisconsin Univ., USA; Nov. 1995, 23p; In English
Contract(s)/Grant(s): DE-FG02-86ER-53218
Report No.(s): UW-CPTC-95-4; DE96-009528; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The response of the toroidal flow velocity to the abrupt locking of it in the vicinity of a magnetohydrodynamic (MHD) tearing-mode- induced magnetic island is examined analytically and numerically using a diffusive transport model in a cylindrical plasma model. The resultant toroidal momentum confinement is shown to degrade significantly after mode locking, as is often observed on many tokamaks and reversed field pinches (RFPs). The degraded toroidal momentum confinement time in the core and edge regions of the plasma are evaluated and compared to experimental observations, The mode locking time scale itself is also investigated by using a model toroidal torque balance equation. The decrease of mode frequency during mode locking seems to be governed mainly by the electromagnetic torque exerted on the resistive layer. For tokamak plasmas, the mode locking time scale is found to be much shorter than the diffusion time scale, which is in general agreement with experimental observations.
DOE
Magnetohydrodynamics; Tokamak Devices; Plasmas (Physics); Flow Velocity; Cylindrical Plasmas; Confinement

19960044579 General Atomics Co., San Diego, CA USA
Aspects of trapped confined alpha physics on TFTR
Petrov, M. P., Ioffe (A. F.) Physical-Technical Inst., Russia; Gorelenkov, N.N., Troitsk Innovation and Fusion Research Inst., Russia; Budny, R. V., Princeton Plasma Physics Lab., USA; Duong, H. H., General Atomics Co., USA; Fisher, R. K., General Atomics Co., USA; McChesney, J. M., General Atomics Co., USA; Mansfield, D. K., Princeton Plasma Physics Lab., USA; Medley, S. S., Princeton Plasma Physics Lab., USA; Parks, P. B., General Atomics Co., USA; Jun. 1996, 12p; In English; 23rd; European Physical Society Conference on Controlled Fusion and Plasma Physics, 24-28 Jun. 1996, Kiev, Ukraine
Contract(s)/Grant(s): DE-FG03-92ER-54150
Report No.(s): GA-A-22323; CONF-9606226-1; DE96-011551; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The energy distributions and radial density profiles of the fast-confined trapped alpha particles in DT experiments on TFTR are being measured in the energy range 0.5 to 3.5 MeV using the Pellet Charge Exchange diagnostic developed in a collaboration involving General Atomics, the A.F. Ioffe Physical-Technical Institute, and the Princeton Plasma Physics Laboratory. A brief description of the measurement technique which involves active neutral particle analysis using the ablation cloud surrounding an injected lithium or pellet as the neutralizer is presented. In the core of quiescent TFTR discharges, measured alpha spectra are consistent with classical slowing down. Measured Doppler broadening of alphas near the birth energy is consistent with the effective temperature of interacting deuterium and tritium ions. Outside the core alpha energy spectra and density profiles are influenced by the magnetic field ripple and appear to be consistent with stochastic ripple diffusion. Sawtooth oscillations lead to the significant broadening of alpha density profiles. The experimental data are modeled using a Fokker-Planck Post TRANSP (FTTP) code which includes the effects of the classical slowing down, magnetic field ripple losses, and the sawtooth mixing of alpha particles. The comparison of the experimental data with the FPPT calculations shows that broadening of trapped alpha density profiles after the sawtooth crashes can be explained by the influence of poloidal electric field generated during the crashes.
DOE
Tokamak Devices; Alpha Particles; Charge Exchange; Trapped Particles; Energy Spectra; Radiation Spectra; Energy Distribution; Density Distribution; Ion Density (Concentration); Plasma Control

19960044581 National Inst. for Fusion Science, Nagoya, Japan
Behavior of hydrogen atoms in boron films during H2 and He glow discharge and thermal desorption
Tsuzuki, K., Graduate Univ. for Advanced Studies, Japan; Natsir, M., Graduate Univ. for Advanced Studies, Japan; Inoue, N., National Inst. for Fusion Science, Japan; Sagara, A., National Inst. for Fusion Science, Japan; Noda, N., National Inst. for Fusion Science, Japan; Motojima, O., National Inst. for Fusion Science, Japan; Mochizuki, T., Hokkaido Univ., Japan; Fujita, I., Hokkaido Univ., Japan; Hino,

T., Hokkaido Univ., Japan; Yamashina, T., Hokkaido Univ., Japan; Sep. 1995, 21p; In English
Report No.(s): NIFS-374; DE96-742085; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Hydrogen absorption and desorption characteristics in boron films deposited on a graphite liner have been studied. Number of hydrogen atoms absorbed in the films is estimated from a decrease in hydrogen pressure during a hydrogen glow discharge. It was 1.9 x 10(exp 17) atoms/cm(exp 2) in the 1 hour discharge after an evacuation of H atoms contained in the original boron films by thermal desorption. Hydrogen atoms were absorbed continuously without saturation for 3 hours during the discharge. Number of H atoms absorbed reached to 2.6 x 10(exp 17) atoms/cm(exp 2) at 3 hour. A discharge in helium was carried out to investigate H desorption characteristics from hydrogen implanted boron films. It was verified that reactivity for hydrogen absorption was recovered after the He discharge. Hydrogen atoms were accumulated in the films by repetition of alternate He and H2 discharge. Thermal desorption experiments have been carried out by raising the liner temperature up to 500 C for films after 1 hour, 3 hours hydrogen discharge and 6 times repetition of H2/He discharges. Most of H atoms in the films were desorbed for all these cases. The slow absorption process was confirmed through the thermal desorption experiments.
DOE
Vapor Deposition; Thin Films; Hydrogen Atoms; Boron; Glow Discharges

19960044604 Lawrence Livermore National Lab., Livermore, CA USA
Electric vortex in MHD flow
Garcia, Manuel, Lawrence Livermore National Lab., USA; May 01, 1995, 11p; In English
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-ID-121162; DE96-012246; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An electric vortex is the circulation of electron space charge about a magnetic field line that is transported by ion momentum. In cold, or low beta flow the vortex diameter is the minimum length scale of charge neutrality. The distinctive feature of the vortex is its radial electric field which manifests the interplay of electrostatics, magnetism, and motion.
DOE
Magnetohydrodynamic Flow; Electrostatics; Magnetic Fields; Space Charge; Vortices

19960044612 Lawrence Livermore National Lab., Livermore, CA USA
Core science and technology development plan for indirect-drive ICF ignition
Powell, H. T., Editor, Lawrence Livermore National Lab., USA; Kilkenny, J. D., Editor, Lawrence Livermore National Lab., USA; Dec. 1995, 343p; In English
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-ID-117076-Rev-1; DE96-012062; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

To define the development work needed to support inertial confinement fusion (ICF) program goals, the authors have assembled this Core Science and Technology (CS and T) Plan that encompasses nearly all science research and technology development in the ICF program. The objective of the CS and T Plan described here is to identify the development work needed to ensure the success of advanced ICF facilities, in particular the National Ignition Facility (NIF). This plan is intended as a framework to facilitate planning and coordination of future ICF programmatic activities. The CS and T Plan covers all elements of the ICF program including laser technology, optic manufacturing, target chamber, target diagnostics, target design and theory, target components and fabrication, and target physics experiments. The CS and T Plan has been divided into these seven different technology development areas, and they are used as level-1 categories in a work breakdown structure (WBS) to facilitate the organization of all activities in this plan. The scope of the CS and T Plan includes all research and development required to support the NIF leading up to the activation and initial operation as an indirect-drive facility. In each of the CS and T main development areas, the authors describe the technology and issues that need to be addressed to achieve NIF performance goals. to resolve all issues and achieve objectives, an extensive assortment of tasks must be performed in a coordinated and timely manner. The authors describe these activities and present planning schedules that detail the flow of work to be performed over a 10-year period corresponding to estimated time needed to demonstrate fusion ignition with the NIF. Besides the benefits to the ICF program, the authors also discuss how the commercial sector and the nuclear weapons science may profit from the proposed research and development program.
DOE
Nuclear Weapons; Laser Applications; Inertial Confinement Fusion; Fabrication

19960044638 Japan Atomic Energy Research Inst., Tokyo, Japan
Relativistic down-shift frequency effect on the application of electron cyclotron emission measurements to JT-60U tokamak plasmas: Second harmonics
Sato, Masayasu, Japan Atomic Energy Research Inst., Japan; Isei, Nobuaki, Japan Atomic Energy Research Inst., Japan; Ishida, Sinichi, Japan Atomic Energy Research Inst., Japan; Nov. 1995, 67p; In Japanese
Report No.(s): JAERI-Research-95-074; DE96-742083; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Effect of relativistic frequency down-shift on the determination of the electron temperature profile from electron cyclotron emission(ECE) in JT-60U tokamak plasmas is studied. The radial shift of the electron temperature profile due to

the effects is not negligible, compared with the spatial resolution of ECE measurement systems of JT-60U. Therefore it is necessary to correct the effect for precise measurement of the electron temperature profile. Dependencies of the shifted frequency on the electron density, electron temperature and toroidal magnetic field are studied for the uniform electron density and parabolic electron temperature profile in JT-60U. It is revealed to be necessary for the estimation of shift due to the relativistic down-shift frequency to take into account of the optical thickness.
DOE
Cyclotron Radiation; Electron Density (Concentration); Plasmas (Physics); Tokamak Devices; Temperature Profiles; Relativistic Effects; Spatial Resolution; Temperature Measurement

19960044639 National Inst. for Fusion Science, Nagoya, Japan
Multi-beamlet focusing of intense negative ion beams by aperture displacement technique
Takeiri, Y., National Inst. for Fusion Science, Japan; Kaneko, O., National Inst. for Fusion Science, Japan; Oka, Y., National Inst. for Fusion Science, Japan; Tsumori, K., National Inst. for Fusion Science, Japan; Asano, E., National Inst. for Fusion Science, Japan; Akiyama, R., National Inst. for Fusion Science, Japan; Kawamoto, T., National Inst. for Fusion Science, Japan; Kuroda, T., National Inst. for Fusion Science, Japan; Ando, A., Tohoku Univ., Japan; Aug. 1995, 42p; In English
Report No.(s): NIFS-368; DE96-742080; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multi-beamlet focusing of an intense negative ion beam has been performed using the beamlet steering by the aperture displacement. The apertures of the grounded grid were displaced as all beamlets of 270 (18 x 15) in the area of 25 cm x 26 cm would be steered to a common point (a focal point) in both the two-stage and the single-stage accelerators. The multi-beamlets were successfully focused and the e-folding half width of 10 cm was achieved 11.2 m downstream from the ion source in both the accelerators. The corresponding gross divergence angle is 9 mrad. The negative ion beamlets are deflected by the magnetic field for the electron deflection at the extraction grid and the deflection direction oppositely changes line by line, resulting in the beam split in the deflection direction. This beamlet deflection was well compensated also using the beamlet steering by the aperture displacement of the grounded grid. The beam acceleration properties related with the beam divergence and the H(-) ion current were nearly the same for both the two-stage and the single-stage accelerators, and were dependent on the ratio of the extraction to the acceleration electric fields.
DOE
Atomic Beams; Ion Beams; Magnetic Fields; Negative Ions

19960044640 National Inst. for Fusion Science, Nagoya, Japan
Energy confinement scaling from the international stellarator database
Stroth, U., Max-Planck-Inst. fuer Plasmaphysik, Germany; Murakami, M., Oak Ridge National Lab., USA; Dory, R. A., Oak Ridge National Lab., USA; Yamada, H., National Inst. for Fusion Science, Japan; Okamura, S., National Inst. for Fusion Science, Japan; Sano, F., Kyoto Univ., Japan; Obiki, T., Kyoto Univ., Japan; Sep. 1995, 58p; In English
Report No.(s): NIFS-375; DE96-742079; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An international stellarator database on global energy confinement is presented comprising data from the ATF, CHS and Heliotron E heliotron/torsatrons and the W7-A and W7-AS shearless stellarators. Regression expressions for the energy confinement time are given for the individual devices and the combined dataset. A comparison with tokamak L mode confinement is discussed on the basis of various scaling expressions. In order to make this database available to interested colleagues, the structure of the database and the parameter list are explained in detail. More recent confinement results incorporating data from enhanced confinement regimes such as H mode are reported elsewhere.
DOE
Tokamak Devices; Stellarators; Plasma Control

19960044641 National Inst. for Fusion Science, Nagoya, Japan
NIFS joint meeting plasma-divertor interactions and fundamentals of boundary plasma-wall interactions
Morita, K., Nagoya Univ., Japan; Kaneko, T., Okayama Univ. of Science, Japan; Mar. 1995, 117p; In Japanese; NIFS Joint Meeting on Plasma Divertor Interactions and Fundamentals of Boundary Plasma-wall Interactions, 6-7 Jan. 1995, Nagoya, Japan
Report No.(s): NIFS-PROC-21; CONF-9501124; DE96-741965; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This issue is the collection of the papers presented at the title conference. The 18 of the presented papers are indexed individually.
DOE
Plasma Interactions; Conferences; Wall Temperature

19960044649 Tokyo Univ., Nuclear Engineering Research Lab., Tokai, Japan
Collection of Summaries of reports on result of research at basic experiment device for nuclear fusion reactor blanket design, 1994
Jul. 1995, 73p; In Japanese
Report No.(s): UTNL-R-0325; DE96-742151; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The development of nuclear fusion reactors reached such stage that the generation of fusion power output comparable with the input power into core plasma is possible. At present, the engineering design of the international thermonuclear fusion experimental reactor, ITER, is advanced by the cooperation of Japan, USA, Europe and Russia, aiming at the start of operation at the beginning of 21st century. This meeting for reporting the results has been held every year, and this time, it was held on May 19, 1995 at University of Tokyo with the theme 'The interface properties of fusion reactor materials and the control of particle transport'. About 50 participants from academic, governmental and industrial circles discussed actively on the theme. Three lectures on the topics of fusion reactor engineering and materials and seven lectures on the basic experiment of fusion reactor blanket design related to the next period project were given at the meeting.
DOE
Blankets (Fusion Reactors); Reactor Design; Thermonuclear Reactions; Reactor Materials; Fusion Reactors; Nuclear Fusion; Breeder Reactors

19960044654 Babcock and Wilcox Co., Lynchburg, VA USA
Tokamak Physics EXperiment (TPX): Toroidal field magnet design, development and manufacture, volume 2, Materials and processes selection
Smith, B. R., Babcock and Wilcox Co., USA; Aug. 15, 1995, 257p; In English
Contract(s)/Grant(s): W-7405-eng-48; B235308
Report No.(s): UCRL-CR-121738; DE96-009589; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This document identifies the candidate materials and manufacturing processes selected for development of the TPX Toroidal Field (TF) Magnet. Supporting rationale and selection criteria are provided for justification and the materials properties database report is included for completeness. Specific properties for each material selection are included in this document.
DOE
Superconducting Magnets; Tokamak Devices; Manufacturing; Data Bases; Product Development

19960045180 Lawrence Livermore National Lab., Livermore, CA USA
Synthesis of fully continuous phase screens for tailoring the focal plane irradiance profiles
Dixit, Sham, Lawrence Livermore National Lab., USA; Feit, Mike, Lawrence Livermore National Lab., USA; Apr. 26, 1996, 24p; In English; Optical Society of America Topical Meeting on Diffractive Optics and Micro Optics, 29 Apr. - 1 May 1996, Boston, MA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-124012; CONF-960465-6; DE96-012212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present an iterative procedure for constructing fully continuous phase screens for tailoring the focal plane intensity distributions. This algorithm alleviates the stagnations experienced in the application of the Gerchberg-Saxton algorithm with a random initial phase screen and leads to efficient distribution of the incident energy into the desired focal plane profile.
DOE
Inertial Confinement Fusion; Laser Plasmas; Far Fields; Irradiance; Algorithms; Iterative Solution

19960045181 Lawrence Livermore National Lab., Livermore, CA USA
A tangentially viewing visible TV system for the DIII-D divertor
Fenstermacher, M. E., Lawrence Livermore National Lab., USA; Meyer, W. H., Lawrence Livermore National Lab., USA; Wood, R. D., Lawrence Livermore National Lab., USA; Nilson, D. G., Lawrence Livermore National Lab., USA; Brooks, N. H., General Atomics Co., USA; Feb. 1996, 22p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-122839; CONF-960543-7; DE96-011813; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A video camera system has been installed on the DIII-D tokamak for 2-D spatial studies of line emission in the lower divertor region. The system views the divertor tangentially from an outer port at approximately the height of the X-point. At the tangency plane the entire divertor from inner wall to outside the DIII-D bias ring is viewed with spatial resolution of approximately 1 cm. The image contains information from approximately 90 degrees of toroidal angle. In a recent upgrade, remotely controllable filter changers were added which have produced images from nominally identical shots using a series of spectral lines. Software was developed to calculate the response function matrix using distributed computing techniques and assuming toroidal symmetry. Standard sparse matrix algorithms are then used to invert the 3-D images onto a poloidal plane. Spatial resolution of the inverted images is 2 cm; higher resolution simply increases the size of the response function matrix. Initial results from a series of experiments with multiple identical shots show that the emission from CII and CIII, which appears along the inner scrape-off layer above and below the X-point during ELMing H-mode, moves outward and becomes localized near the X-point in Partially Detached Divertor (PDD) operation.
DOE
Divertors (Fusion Reactors); Tokamak Devices; Line Spectra; Plasma Diagnostics; Emission Spectra

19960045201 National Inst. for Fusion Science, Nagoya, Japan

Control of discharge conditions to reduce hydrogen content in low Z films produced with DC glow

Natsir, M., Graduate Univ. for Advanced Studies, Japan; Sagara, A., National Inst. for Fusion Science, Japan; Tsuzuki, K., Graduate Univ. for Advanced Studies, Japan; Tsuchiya, B., Nagoya Univ., Japan; Hasegawa, Y., Nagoya Univ., Japan; Motojima, O., National Inst. for Fusion Science, Japan; Sep. 1995, 22p; In English

Report No.(s): NIFS-373; DE96-742084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Boronization at near room temperature has been performed in plasma processing teststand (PPT) by using a 5% diborane gases B2H6 in He on electrically floating or unfloating Al samples under various conditions on DC glow discharge power or total gas pressure. The hydrogen concentration was analyzed by using elastic recoil detection method (ERD) and a new modified normalizing technique with Rutherford back scattering (RBS). Results showed that a high growth rate of film formation and floating surface were effective in reducing hydrogen concentration in B films. This result was in good agreement with earlier measurements of H with flash filament (FF) desorption method. In particular the H/B ratio was reduced by decreasing ions but increasing radicals for B film formation.

DOE

Glow Discharges; Thin Films; Boron; Coatings; Hydrogen; Plasmas (Physics)

19960045230 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR

The algorithm for ion temperature determination by charge-exchange neutrals spectra

Dnestrovskij, Yu. N., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Melnikov, A. V., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Smirnov, A. P., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Khutoretsky, A. V., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; 1994, 26p; In English

Report No.(s): IAE-5780/6; DE96-619981; Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

The mathematical model and the algorithm for ion temperature determination by charge-exchange neutral spectra are proposed. The effect of ripple-trapped particles is taken into account. Methods of elementary processes cross-sections evaluation, equilibrium description for noncircular shape tokamaks, 'cold' neutral density representation are considered. The algorithm is realized in a computer code. This code is planned for applying to the T-15 and ASDEX-Upgrade tokamaks.

DOE

Algorithms; Charge Transfer; Tokamak Devices; Trapped Particles; Mathematical Models

19960045240 Lawrence Livermore National Lab., Livermore, CA USA

Thomson scattering stray light reduction techniques using a CCD camera

Nilson, D. G., Lawrence Livermore National Lab., USA; Hill, D. N., Lawrence Livermore National Lab., USA; Evans, J. C., Lawrence Livermore National Lab., USA; Carlstrom, T. N., Lawrence Livermore National Lab., USA; Hsieh, C. L., Lawrence Livermore National Lab., USA; Stockdale, R. E., Lawrence Livermore National Lab., USA; Feb. 1996, 22p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA

Contract(s)/Grant(s): W-7405-eng-48; DE-AC03-89ER-51114

Report No.(s): UCRL-JC-124078; CONF-960543-6; DE96-011812; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The DIII-D Thomson scattering system has been expanded to measure divertor plasma temperatures from 1-500 eV and densities from 0.05 to 8 x 10(exp 20) m(exp -3). to complete this system, a difficult stray light problem was overcome to allow for an accurate Rayleigh scattering density calibration. The initial stray light levels were over 500 times higher than the expected Rayleigh scattered signal. Using a CCD camera, various portions of the vessel interior were examined while the laser was fired through the vessel in air at atmospheric pressure. Image relaying, exit window tilting, entrance and exit baffle modifications, and a beam polarizer were then used to reduce the stray light to acceptable levels. The CCD camera gave prompt feedback on the effectiveness of each modification, without the need to re-establish vacuum conditions required when using the normal Avalanche Photodiode Detectors (APD). Once the stray light was sufficiently reduced, the APD detectors provided the signal time history to more accurately identify the source location. We have also found that certain types of high reflectance dielectric coatings produce 10 to 15 times more scatter than other types of more conventional coatings. by using low-scatter mirror coatings and these new stray light reduction techniques, we now have more flexibility in the design of complex Thomson scattering configurations required to probe the central core and the new radiative divertor regions of the DIII-D vessel.

DOE

Plasma Diagnostics; CCD Cameras; Divertors (Fusion Reactors); Plasma Density; Plasma Temperature; Thomson Scattering; Tokamak Devices

19960045244 Lawrence Livermore National Lab., Livermore, CA USA

Measurement of the in-flight pusher density of an indirect drive capsule implosion core using x-ray backlighting

Kalantar, D. H., Lawrence Livermore National Lab., USA; Haan, S. W., Lawrence Livermore National Lab., USA; Hammel, B. A., Lawrence Livermore National Lab., USA; Keane,

C. J., Lawrence Livermore National Lab., USA; Landen, O. L., Lawrence Livermore National Lab., USA; Munro, D. H., Lawrence Livermore National Lab., USA; May 30, 1996, 6p; In English; 24th; European Conference on Laser Interaction with Matter, 3-7 Jun. 1996, Madrid, Spain
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123294; CONF-9606229-2; DE96-012187; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Both the efficiency of an implosion and the growth rate of hydrodynamic instability increase with the aspect ratio of an implosion. In order to study the physics of implosions with high Rayleigh-Taylor growth factors, we use doped ablators which should minimize x-ray preheat and shell decompression, and hence increase in-flight aspect ratio. We use x-ray backlighting techniques to image the indirectly-driven capsules. We record backlit 4.7 KeV images of the full capsule throughout the implosion phase with 55 ps and 15 micron resolution. We use these images to measure the in-flight aspect ratios for doped ablators, and we infer the radial density profile as a function of time by Abel inverting the transmission profiles.
DOE
Inertial Confinement Fusion; Aspect Ratio; Implosions; X Rays; Ablation; Density Distribution; Capsules; Imaging Techniques

19960045263 Lawrence Livermore National Lab., Livermore, CA USA
Fabrication of large aperture kinoform phase plates in fused silica for smoothing focal plane intensity profiles
Rushford, Mike, Lawrence Livermore National Lab., USA; Dixit, Sham, Lawrence Livermore National Lab., USA; Thomas, Ian, Lawrence Livermore National Lab., USA; Perry, Mike, Lawrence Livermore National Lab., USA; Apr. 26, 1996, 27p; In English; Optical Society of America Topical Meeting on Diffractive Optics and Micro Optics, 29 Apr. - 1 May 1996, Boston, MA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-124013; CONF-960465-5; DE96-012213; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have fabricated large aperture (40-cm) kinoform phase plates for producing super-Gaussian focal plane intensity profiles. The continuous phase screen, designed using a new iterative procedure, was fabricated in fused silica as a 16-level, one-wave deep rewrapped phase profile using a lithographic process and wet etching in buffered hydrofluoric acid. The observed far-field contains 94% of the incident energy inside the desired spot.
DOE
Inertial Confinement Fusion; Far Fields; Irradiation; Silica Glass; Optical Equipment

19960045396 Lawrence Livermore National Lab., Livermore, CA USA
X-ray diagnostics of hohlraum plasma flow
Back, C. A., Lawrence Livermore National Lab., USA; Glenzer, S. H., Lawrence Livermore National Lab., USA; Landen, O. L., Lawrence Livermore National Lab., USA; MacGowan, B. J., Lawrence Livermore National Lab., USA; Shepard, T. D., Lawrence Livermore National Lab., USA; May 13, 1996, 18p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123283; CONF-960543-11; DE96-010406; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study we use spectroscopy and x-ray imaging to investigate the macroscopic plasma flow in mm-sized laser-produced hohlraum plasmas. by using multiple diagnostics to triangulate the emission on a single experiment, we can pinpoint the position of dopants placed inside the hohlraum. X-ray emission from the foil has been used in the past to measure electron temperature. Here we analyze the spatial movement of dopant plasmas for comparison to hydrodynamic calculations.
DOE
Electron Energy; Hohlraums; Magnetohydrodynamic Flow; Plasmas (Physics); X Ray Imagery

19960045413 Japan Atomic Energy Research Inst., Dept. of Fusion Plasma Research; Naka Fusion Research Establishment., Tokyo, Japan
Recent results of H-mode confinement study in JT-60U (April-September, 1995)
Nov. 1995, 75p; In English
Report No.(s): JAERI-Research-95-075; DE96-742602; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Improvement in the performance of energy confinement is one of the most important issues to realize thermonuclear fusion reactors. The H-mode is one of excellent improved confinement modes. From the view point of steady-state operation, the ELMy H-mode is considered to be a principal operation mode in ITER. For the engineering design of the ITER, there still remain issues to be clarified on the H-mode characteristics. These issues are required to be studied on the present tokamaks as ITER physics research needs. In order to satisfy the above request, experiments of the H-mode confinement have been carried out on JT-60U. Recent results of H-mode confinement study in JT-60U during April to September, 1995 are summarized in the present report. The scaling of high T(sub i) H-mode confinement is described in section 2. The time behaviour of transport properties are shown in sections 3 and 4. Result of the non-dimensional transport experiment is presented in section 5. The H-mode transition is investigated in sections 6, 7, 8 and 9; threshold

power scaling, parametric study on edge local quantities, effect of edge neutrals, and H-L back transition. The onset condition of ELMs is studied in section 10.
DOE
Thermonuclear Reactions; Confinement; Tokamak Devices; Transport Properties; Charged Particles; Fusion Reactors

19960045416 Japan Atomic Energy Research Inst., Dept. of Fusion Plasma Research. Naka Fusion Research Establishment., Ibaraki, Japan
Study of density limit in JT-60 joule heated plasmas
Shirai, Hiroshi, Japan Atomic Energy Research Inst., Japan; Shimizu, Katsuhiro, Japan Atomic Energy Research Inst., Japan; Takizuka, Tomonori, Japan Atomic Energy Research Inst., Japan; Hirayima, Toshio, Japan Atomic Energy Research Inst., Japan; Azumi, Masafumi, Japan Atomic Energy Research Inst., Japan; Nov. 1995, 53p; In English
Report No.(s): JAERI-Research-95-079; DE96-742580; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Impurities which mingle in tokamak plasmas cause dominant radiation loss in the high density regime and the energy balance of plasma is lost. This gives rise to MHD instability and results in major disruption. Density limit in joule heated plasmas has been studied by using one dimensional transport code combined with MHD instability analysis code. When the diffusion of impurity is taken into account, the numerically obtained density limit diagram or Hugill diagram quantitatively agrees well with that obtained in the experiment. It is also clarified that the corona-equilibrium model overestimates the density limit.
DOE
Charged Particles; Tokamak Devices; Plasmas (Physics); Magnetohydrodynamic Stability; Plasma Density; Plasma Loss

19960045422 China Nuclear Information Centre, Beijing, China
Numerical simulation of edge plasma in tokamak
Guishi, Luan, Academia Sinica, China; Yiping, Chen, Academia Sinica, China; Lijian, Qiu, Academia Sinica, China; Feb. 1996, 14p; In English
Report No.(s): CNIC-01034; ASIPP-0045(02/1996); DE96-623448; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The transport process and transport property of plasma in edge layer of Tokamak are simulated by solving numerically two-dimensional and multi-fluid plasma transport equations using suitable simulation code. The simulation results can show plasma parameter distribution characteristics in the area of edge layer, especially the characteristics near the first wall and divertor target plate. The simulation results play an important role in the design of divertor and first wall of Tokamak.
DOE
Computerized Simulation; Distribution Functions; Plasmas (Physics); Plasma Layers; Tokamak Devices; Transport Properties

19960045430 Lawrence Livermore National Lab., Livermore, CA USA
X-ray backlit imaging measurement of in-flight pusher density for an indirect drive capsule implosion
Kalantar, D. H., Lawrence Livermore National Lab., USA; Haan, S. W., Lawrence Livermore National Lab., USA; Hammel, B. A., Lawrence Livermore National Lab., USA; Landen, O. I., Lawrence Livermore National Lab., USA; Keane, C. J., Lawrence Livermore National Lab., USA; Munro, D. H., Lawrence Livermore National Lab., USA; May 06, 1996, 20p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123285; CONF-960543-10; DE96-010407; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Both the efficiency of an implosion and the growth rate of hydrodynamic instability increase with the aspect ratio of an implosion. In order to study the physics of implosions with high Rayleigh-Taylor growth factors, we use doped ablators which should minimize x-ray preheat and shell decompression, and hence increase in-flight aspect ratio. We use x-ray backlighting techniques to image the indirectly-driven capsules. We record backlit 4.7 keV images of the full capsule throughout the implosion phase with 55 ps and 15 micrometer resolution. We use these images to measure the in-flight aspect ratios for doped ablators, and we inferred the radial density profile as a function of time by Abel inverting the x-ray transmission profiles.
DOE
Ablative Materials; Aspect Ratio; Pressure Reduction; X Ray Imagery; Doped Crystals; Abel Function

19960045431 Lawrence Livermore National Lab., Livermore, CA USA
Development and characterization of a CCD camera system for use on six-inch manipulator systems
Logory, L. M., Lawrence Livermore National Lab., USA; Bell, P. M., Lawrence Livermore National Lab., USA; Conder, A. D., Lawrence Livermore National Lab., USA; Lee, F. D., Lawrence Livermore National Lab., USA; May 03, 1996, 13p; In English; 11th; Annual High-temperature Plasma Diagnostics Conference, 12-16 May 1996, Monterey, CA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123281; CONF-960543-12; DE96-010404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Lawrence Livermore National Laboratory has designed, constructed, and fielded a compact CCD camera system for use on the Six Inch Manipulator (SIM) at the Nova laser facility. The camera system has been designed to directly replace the 35 mm film packages on all active SIM-based diagnostics. The unit's electronic package is constructed for small size and high thermal conductivity using proprietary printed circuit board technology, thus reducing the size of the overall camera and improving its performance when operated within the vacuum environment of the Nova laser target chamber. The camera has been calibrated and found to yield a linear response, with superior dynamic range and signal-to-noise levels as compared to T-Max 3200 optic film, while providing real-time access to the data. Limiting factors related to fielding such devices on Nova will be discussed, in addition to planned improvements of the current design.
DOE
CCD Cameras; Printed Circuits; Manipulators; Real Time Operation; Signal to Noise Ratios; Thermal Conductivity; Diagnosis; Calibrating

19960045441 Hughes STX, Inc., Greenbelt, MD USA
Effects of Spatial Gradients on Electron Runaway Acceleration
MacNeice, Peter, Hughes STX, Inc., USA; Ljepojevic, N. N., South Bank Polytechnic, UK; Aug. 1996, 38p; In English
Contract(s)/Grant(s): NAS5-32350
Report No.(s): NASA-CR-199883; NAS 1.26:199883; Rept-96B00104; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The runaway process is known to accelerate electrons in many laboratory plasmas and has been suggested as an acceleration mechanism in some astrophysical plasmas, including solar flares. Current calculations of the electron velocity distributions resulting from the runaway process are greatly restricted because they impose spatial homogeneity on the distribution. We have computed runaway distributions which include consistent development of spatial gradients in the energetic tail. Our solution for the electron velocity distribution is presented as a function of distance along a finite length acceleration region, and is compared with the equivalent distribution for the infinitely long homogenous system (i.e., no spatial gradients), as considered in the existing literature. All these results are for the weak field regime. We also discuss the severe restrictiveness of this weak field assumption.
Author
Electron Acceleration; Velocity Distribution; Spatial Distribution; Electric Fields; Distribution Functions

19960045459 Los Alamos National Lab., Plasma Physics Branch., NM USA
Particle contamination control in plasma processing: Building-in reliability for semiconductor fabrication
Selwyn, G. S., Los Alamos National Lab., USA; 1995, 9p; In English; 1995 International Integrated Reliability Workshop, 22-25 Oct. 1995, Fallenleaf, CA, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-96-570; CONF-9510357-1; DE96-008700; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Plasma processing is used for approximately 35% of the process steps required for semiconductor manufacturing. Recent studies have shown that plasma processes create the greatest amount of contaminant dust of all the manufacturing steps required for device fabrication. Often, the level of dust in a plasma process tool exceeds the cleanroom by several orders of magnitude. Particulate contamination generated in a plasma tool can result in reliability problems as well as device failure. Inter-level wiring shorts different levels of metallization on a device is a common result of plasma particulate contamination. We have conducted a thorough study of the physics and chemistry involved in particulate formation and transport in plasma tools. In-situ laser light scattering (LLS) is used for real-time detection of the contaminant dust. The results of this work are highly surprising: all plasmas create dust; the dust can be formed by homogeneous as well as heterogeneous chemistry; this dust is charged and suspended in the plasma; additionally, it is transported to favored regions of the plasma, such as those regions immediately above wafers. Fortunately, this work has also led to a novel means of controlling and eliminating these unwanted contaminants: electrostatic 'drainpipes' engineered into the electrode by means of specially designed grooves. These channel the suspended particles out of the plasma and into the pump port before they can fall onto the wafer.
DOE
Semiconductors (Materials); Contamination; Electrostatics; Heterogeneity; Light Scattering; Real Time Operation; Plasmas (Physics)

19960045466 China Nuclear Information Centre, Beijing, China
Multi-dimensional neutronics calculation
Chenglun, You, Southwestern Inst. of Physics, China; Ling-Qiao, Wu, Southwestern Inst. of Physics, China; Dec. 1995, 17p; In English
Report No.(s): CNIC-01015; SIP-0087; DE96-623582; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The designs of fission-suppressed blanket were performed for different tritium breeders and coolants, U-Pu Cycle was adopted due to its available technology. During design the toroidal effect and resonance energy self-shielding effect have been taken into account. After optimization calculation, the results based on a one-dimensional model show that the required neutronics performance can be achieved. Finally, multi-dimensional neutronics calculations were performed using Monte-Carlo code MCNP with energy continu-

ous cross section library, three-dimensional neutron source sample code was developed, the effect of neutron source density distribution on the blanket neutronics performance was studied. The results show that for Li2O and liquid Li self-cooled blanket under the condition of self-sustained tritium the production of Pu-239 can reach 4000 kg/a for fusion power of 2000 MW and availability of 0.75.
DOE
Neutron Sources; Coolants; Fission; Mathematical Models; Monte Carlo Method

19960045528 Japan Atomic Energy Research Inst., Tokyo, Japan
The influence of the analog-to-digital conversion error on the JT-60 plasma position/shape feedback control system
Yoshida, Michiharu, Japan Atomic Energy Research Inst., Japan; Kurihara, Kenichi, Japan Atomic Energy Research Inst., Japan; Dec. 1995, 36p; In Japanese
Report No.(s): JAERI-Tech-95-053; DE96-742604; Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

In the Plasma Feedback Control System (PFCS) and the Direct Digital Controller (DDC) for the poloidal field coil power supply in the JT-60 tokamak, it is necessary to observe signals of all the poloidal field coil currents. Each of the signals, originally measured by a single sensor, is distributed to the PFCS and DDC through different cable routes and different analog-to-digital converters from each other. This produces the conversion error to the amount of several bits. Consequently, proper voltage from feedback calculation cannot be applied to the coil, and hence the control performance is possibly supposed to deteriorate to a certain extent. This paper describes how this error makes an influence on the plasma horizontal position control and how to improve the deteriorated control performance.
DOE
Tokamak Devices; Linear Accelerators; Numerical Control

19960045547 Centro de Investigaciones Energeticas, Madrid, Spain
Transition probabilities for lines of Cr (II), Na (II) and Sb (I) by laser produced plasma atomic emission spectroscopy ***Probabilidades de transicion de algunos niveles de Cr II, Na II y Sb I mediante espectroscopia de plasmas producidos por laser***
Gonzalez, A. M., Centro de Investigaciones Energeticas, Spain; Ortiz, M., Centro de Investigaciones Energeticas, Spain; Campos, J., Centro de Investigaciones Energeticas, Spain; 1995, 133p; In Spanish
Report No.(s): CIEMAT-769; DE96-721780; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Absolute transition probabilities for lines of Cr II, Na II and Sb I were determined by emission spectroscopy of laser induced plasmas. The plasma was produced focusing the emission of a pulsed Nd-YAG laser on solid samples containing the atom in study. The light arising from the plasma region was collected by spectrometer. The detector used was a time-resolved optical multichannel analyzer (OMA 3 EG and G). The wavelengths of the measured transitions range from 2000 to 4100 A. The spectral resolution of the system was 0.2 A. The method can be used in insulators materials such as ClNa crystals and in metallic samples such as Al-Cr and Sn-Sb alloys. to avoid self-absorption effects the alloys were made with low Sb or Cr content. Relative transition probabilities have been determined from measurements of emission-line intensities and were placed on an absolute scale by using, where possible, accurate experimental lifetime values form the literature or theoretical data. From these measurements, values for plasma temperature (8000-24,000 K), electron densities (approx. 10 (exp 16) cm(exp -3), and self-absorption coefficients have been obtained.
DOE
Laser Plasmas; Atomic Spectra; Emission Spectra; YAG Lasers; Pulsed Lasers; Transition Probabilities; Line Spectra

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SOLID-STATE PHYSICS

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19960042696 Argonne National Lab., IL USA
Investigation of the interactions of H2O(g) with Li2ZrO3
Kopasz, J. P., Argonne National Lab., USA; Johnson, C. E., Argonne National Lab., USA; [1995], 16p; In English; 4; International Workshop on Ceramic Breeder Blanket Interactions, 9-13 Oct. 1995, Kyoto, Japan
Contract(s)/Grant(s): W-31-109-eng-38
Report No.(s): ANL/CMT/CP-88543; CONF-9510336-1; DE96-006748; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because of its low tritium inventory and thermodynamic stability, Lithium zirconate is one of the favored candidates for use as a tritium breeding material in fusion reactor designs. Experience indicates that lithium zirconate is less reactive with water vapor than lithium oxide; however, very little work has been performed to characterize the extent of reaction between water vapor and lithium zirconate. Since such interactions may have an impact on the tritium inventory and ultimately on the design of the ceramic breeder blanket, it is important to have a quantitative assessment of these reactions. The recent work characterizing the interaction of water vapor with lithium zirconate is described.
DOE

Breeder Reactors; Blankets (Fusion Reactors); Fusion Reactors; Tritium; Water Vapor; Reactor Design

19960042699 Los Alamos National Lab., NM USA
Mu-SR studies of Li-doped La2CuO4
Le, L. P., Los Alamos National Lab., USA; Heffner, R. H., Los Alamos National Lab., USA; MacLaughlin, D. E., California Univ., USA; Kojima, K., Columbia Univ., USA; Luke, G. M., Columbia Univ., USA; Nachumi, B., Columbia Univ., USA; Uemura, Y. J., Columbia Univ., USA; Sarrao, J. L., National High Magnetic Field Lab., USA; [1996], 14p; In English; 7th; International Conference on Muon Spin Rotation, 15-19 Apr. 1996, Nikko, Japan
Contract(s)/Grant(s): W-7405-eng-36; NSF DMR-94-18991; NSF DMR-95-10454
Report No.(s): LA-UR-96-1192; CONF-9604128-4; DE96-010475; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Magnetic properties of the Li-doped cuprates La2Cu(1-x)Li(x)O4 (where x = 0.01, 0.05, 0.10, 0.45, and 0.50) have been studied by mu-SR. For low Li concentrations (x (le) 0.10) the authors find a rapid suppression of T(sub N) as x increases, but little change in the magnitude and temperature dependence of the AFM order parameter. This indicates that Li doping effectively destroys AFM without strongly affecting the onsite Cu moments and the shape of the spin wave excitation spectrum. For high Li concentrations they find magnetic clusters in about 15% of the sample volume; the remaining volume is non-magnetic, suggesting possible single-state formation.
DOE
Lithium; Lanthanum Oxides; Muon Spin Rotation; Magnetic Properties; Copper Oxides; Doped Crystals; Additives

19960042722 Los Alamos National Lab., NM USA
Electrically inactive poly-silicon grain boundaries
Chen, S. P., Los Alamos National Lab., USA; Kress, J. D., Los Alamos National Lab., USA; Voter, A. F., Los Alamos National Lab., USA; Albers, R. C., Los Alamos National Lab., USA; [1996], 20p; In English; 4th; International Symposium on Process Physics and Modeling In Semiconductor Technology, 5-10 May 1996, Los Angeles, CA, USA
Contract(s)/Grant(s): W-7405-eng-36
Report No.(s): LA-UR-96-0425; CONF-9605155-1; DE96-008152; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Structures, energies, and electronic properties of symmetric (001) tilt grain boundaries in Si have been studied using Stillinger-Weber and Tersoff classical potentials, and semi-empirical (tight-binding) electronic structure methods. The calculated lowest energy (310) grain boundary structure and electronic properties are consistent with previous TEM measurement and calculations. For the controversial (710) grain boundaries, the tight-binding calculations do not show any electronic energy levels in the band gap. This indicates that with every atom fully fourfold coordinated, the (710) grain boundary should be electrically inactive. Some high-energy metastable grain boundaries were found to be electrically active by the presence of the levels introduced in the band gap. Also, the vacancy concentration at the (310) GB was found to be enhanced by many orders of magnitude relative to bulk. The dangling bond states of the vacancies should be electrically active.
DOE
Grain Boundaries; Silicon; Energy Levels; Crystal Defects; Polycrystals

19960042742 Sandia National Labs., Albuquerque, NM USA
Ion implantation in compound semiconductors for high-performance electronic devices
Zolper, J. C., Sandia National Labs., USA; Baca, A. G., Sandia National Labs., USA; Sherwin, M. E., Sandia National Labs., USA; Klem, J. F., Sandia National Labs., USA; [1996], 16p; In English; 189th; Meeting of the Electrochemical Society (ECS), 5-10 May 1996, Los Angeles, CA, USA; Sponsored by Electrochemical Society, Inc., USA
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-0802C; CONF-960502-6; DE96-008169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced electronic devices based on compound semiconductors often make use of selective area ion implantation doping or isolation. The implantation processing becomes more complex as the device dimensions are reduced and more complex material systems are employed. The authors review several applications of ion implantation to high performance junction field effect transistors (JFETs) and heterostructure field effect transistors (HFETs) that are based on compound semiconductors, including: GaAs, AlGaAs, InGaP, and AlGaSb.
DOE
Semiconductors (Materials); Ion Implantation; Additives; Doped Crystals; JFET

19960042893 Niels Bohr Inst., Fysik og Geofysik, Copenhagen, Denmark
High pressure studies of YbH2 and YbD2
StaunOlsen, J., Niels Bohr Inst., Denmark; Steenstrup, S., Niels Bohr Inst., Denmark; Gerward, L., Niels Bohr Inst., Denmark; 1995, 7p; In English
Report No.(s): KU-HCOE-NBI-R-1995-05; DE96-615590; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High-pressure x-ray diffraction was performed on YbH2 and YbD2 up to 61 GPa. A first order transition from an orthorhombic structure to a hexagonal structure has been found at about 16 GPa. Bulk modulus B(sub 0) and its pressure

derivative B(sub o)' in the orthorhombic phase were found to be: YbH2, 36 GPa and 6.7, YbD2, 55 GPa and 3.7. In the hexagonal phase: YbH2, 132 GPa and 0.4, YbD2, 154 GPa and 0.4. A valence change seems to start in the hexagonal phase.
DOE
Ytterbium Compounds; Phase Transformations; X Ray Diffraction; Bulk Modulus; Equations of State

19960042895 NASA Lewis Research Center, Cleveland, OH USA
Simulation of tip-sample interaction in the atomic force microscope
Good, Brian S., NASA Lewis Research Center, USA; Banerjea, Amitava, Bose (Satyendra Nath) National Centre for Basic Sciences, India; 1994, 20p; In English
Report No.(s): NASA-TM-111699; NAS 1.15:111699; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent simulations of the interaction between planar surfaces and model Atomic Force Microscope (AFM) tips have suggested that there are conditions under which the tip may become unstable and 'avalanche' toward the sample surface. Here we investigate via computer simulation the stability of a variety of model AFM tip configurations with respect to the avalanche transition for a number of fcc metals. We perform Monte-Carlo simulations at room temperature using the Equivalent Crystal Theory (ECT) of Smith and Banerjea. Results are compared with recent experimental results as well as with our earlier work on the avalanche of parallel planar surfaces. Our results on a model single-atom tip are in excellent agreement with recent experiments on tunneling through mechanically-controlled break junctions.
Author
Computerized Simulation; Atomic Force Microscopy; Interatomic Forces; Crystal Surfaces; Microscopes

19960043050 Lawrence Livermore National Lab., Livermore, CA USA
Large GMR values of sputtered Co/Cu multilayer structures with Co-Cu buffer layers
Huai, Y., Lawrence Livermore National Lab., USA; Vernon, S. P., Lawrence Livermore National Lab., USA; Stearns, D. G., Lawrence Livermore National Lab., USA; Cerjan, C., Lawrence Livermore National Lab., USA; Kania, D. R., Lawrence Livermore National Lab., USA; Feb. 29, 1996, 10p; In English; Conference on Magnetism and Magnetic Materials, 9-12 Apr. 1996, Seattle, WA, USA
Contract(s)/Grant(s): W-7405-eng-48
Report No.(s): UCRL-JC-123001; CONF-960425-6; DE96-009813; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We demonstrate large giant magnetoresistance (GMR) values of Co/Cu multilayers (MLs) sputtered on combined Co18(angstrom)/Cu48(angstrom) buffer layer. GMR values at room temperature reach 62% at the first antiferromagnetically (AF) coupling peak and 33% at the 2nd AF coupled peak, which are very close to those found in Co/Cu MLs sputtered on a Fe buffer layer. The large GMR effect is attributed to the superior superlattice structure of these samples, as evidenced by the x-ray reflectivity data as well as the TEM micrographs. In particular, the role of thin Co initial layer deposited beneath the Cu buffer layer on improved ML structure has been clarified from cross-sectional micrographs of high-resolution TEM.
DOE
Superlattices; Magnetoresistivity; Antiferromagnetism

19960043051 Sandia National Labs., Albuquerque, NM USA
Effect of hydrogen on Ca and Mg acceptors in GaN
Lee, J. W., Florida Univ., USA; Pearton, S. J., Florida Univ., USA; Zolper, J. C., Sandia National Labs., USA; Stall, R. A., Emcore Corp., USA; [1996], 14p; In English; 189th; Meeting of the Electrochemical Society (ECS), 5-10 May 1996, Los Angeles, CA, USA; Sponsored by Electrochemical Society, Inc., USA
Contract(s)/Grant(s): DE-AC04-94AL-85000; N00014-92-3-1895; NSF DMR-94-21109
Report No.(s): SAND-96-0784C; CONF-960502-7; DE96-008172; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The influence of minority carrier injection on the reactivation of hydrogen passivated Mg in GaN at 175 C has been investigated in p-n junction diodes. The dissociation of the neutral MgH complexes is greatly enhanced in the presence of minority carrier and the reactivation process follows second order kinetics. Conventional annealing under zero-bias conditions does not produce Mg-H dissociation until temperatures (ge) 450 C. These results provide an explanation for the e-beam induced reactivation of Mg acceptors in hydrogenated GaN. Exposure to a hydrogen plasma at 250 C of p-type GaN (CA) prepared by either Ca(+) or Ca(+) plus P(+) coimplantation leads to a reduction in sheet carrier density of approximately an order of magnitude (1.6 x 10(exp 12) cm(exp -2) to 1.8 x 10(exp 11) cm(exp -2), and an accompanying increase in hole mobility (6 cm(exp 2)/Vs to 18 cm(exp 2)/Vs). The passivation process can be reversed by post-hydrogenation annealing at 400--500 C under a N2 ambient. This reactivation of the acceptors is characteristic of the formation of neutral (Ca-H) complexes in the GaN. The thermal stability of the passivation is similar to that of Mg-H complexes in material prepared in the same manner (implantation) with similar initial doping levels. Hydrogen passivation of acceptor dopants in GaN appears to be a ubiquitous phenomenon, as it is in other p-type semiconductors.
DOE
Carrier Injection; P-Type Semiconductors; P-N Junctions; Minority Carriers; Implantation; Hole Mobility; Electron Beams; Annealing; Acceptor Materials

19960044482 Sandia National Labs., Albuquerque, NM USA

Radiation-induced charge trapping in bipolar base oxides

Fleetwood, D. M., Sandia National Labs., USA; Riewe, L. C., Sandia National Labs., USA; Witczak, S. C., Arizona Univ., USA; Schrimpf, R. D., Arizona Univ., USA; [1996], 5p; In English; Institute of Electrical and Electronics Engineers/Nuclear and Space Radiation Effects Conference, 15-19 Jul. 1996, Indian Wells, CA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-0406C; CONF-960773-1; DE96-006383; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Capacitance-voltage and thermally stimulated current methods are used to investigate radiation induced charge trapping in bipolar base oxides. Results are compared with models of oxide and interface trap charge buildup at low electric fields.

DOE

P-N Junctions; Capacitance-Voltage Characteristics; Semiconductors (Materials); Solid State Physics; Radiation Trapping

19960044498 Brookhaven National Lab., Upton, NY USA

X-ray search for CDW in single crystal YBa2CU3O(7-delta)

Wochner, P., Brookhaven National Lab., USA; Isaacs, E., Bell Telephone Labs., Inc., USA; Moss, S. C., Houston Univ., USA; Zschack, P., Oak Ridge Associated Universities, Inc., USA; Giapintzakis, J., Illinois Univ., USA; Ginsberg, D. M., Illinois Univ., USA; [1996], 9p; In English; 10th; Anniversary High Temperature Superconductivity Workshop on Physics, Materials and Applications, 12-16 Mar. 1996, Houston, TX, USA

Contract(s)/Grant(s): DE-AC02-76CH-00016; DMR-92-08420; DMR-91-20000

Report No.(s): BNL-63039; CONF-960366-11; DE96-010688; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Recently, H. L. Edwards et al. observed, in STM experiments at 20K, modulations in the CuO chain layer of cold-cleaved single crystals of YBa2Cu3O(7-delta) which they interpreted as a possible charge density wave (CDW). Since X-ray scattering is an ideal tool for the study of static or dynamic lattice displacements, we performed a synchrotron X-ray study at beamline X14 at the NSLS of BNL on a high quality single crystal of YBa2Cu3O(7-delta), which was mainly single domain with a spacially well localized volume fraction of other twin orientations of roughly 10%. Appropriate scattering configurations were chosen to enable observations of longitudinal or transverse CDWs with polarization either in the chain direction, (parallel) <001 or (perpendicular) to it in <001. The X-ray energy of 16keV allowed us to reach large momentum transfers to increase the sensitivity to lattice displacements. In none of our scans, which definitely covered the case of a 1-dimensional longitudinal CDW with propagation in the b direction as proposed by Edwards et al., did we find intensity other than the main Bragg peak(s) and the twin reflections. We therefore suspect that the STM finding may be a surface-induced phenomenon.

DOE

Copper Oxides; X Ray Scattering; Synchrotrons; Concentration (Composition); Density (Number/Volume); Bragg Curve; Single Crystals

19960044504 Argonne National Lab., IL USA

Stability constants of europium complexes with a nitrogen heterocycle substituted methane-1,1-diphosphonic acid

Jensen, M. P., Argonne National Lab., USA; Rickert, P. G., Argonne National Lab., USA; Schmidt, M. A., Argonne National Lab., USA; Nash, K. L., Argonne National Lab., USA; [1996], 20p; In English; 21st; Rare Earth Research Conference, 7-12 Jul. 1996, Duluth, MN, USA

Contract(s)/Grant(s): W-31-109-eng-38

Report No.(s): ANL/CHM/CP-89020; CONF-960796-3; DE96-011158; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Even in moderately acidic solutions ([H(+)] greater than 0.01 M), N-piperidinomethane-1,1-diphosphonic acid (H4 PMDPA) is a strong complexant of trivalent lanthanide ions that shows enhanced complex solubility over previously studied 1,1-diphosphonic acids. The protonation constants of PMDPA in 2.0 M H/NaClO4 were determined by potentiometric and NMR titrations, and the stability constants for formation of complexes with Eu(3+) were determined by solvent extraction. Difference in protonation equilibria induced by addition of the nitrogen heterocycle results in an increase in the complexation strength of PMDPA. In solutions containing 0.1 M H(+) and ligand concentrations greater than 0.02 M, PMDPA is the most effective 1,1-diphosphonic acid for europium complexation studied thus far.

DOE

Europium; Solvent Extraction; Trivalent Ions; Ligands; Nuclear Magnetic Resonance; Methane; Nitrogen; Acidity

19960044520 Argonne National Lab., Energy Technology Div., IL USA

Phase development in partial-melt processing of silver-clad Bi2.15SR1.83Ca1.02Cu2O(sub x) tapes

Jiang, Ming, Argonne National Lab., USA; Delaney, W. E., Argonne National Lab., USA; Lanagan, M. T., Argonne National Lab., USA; Olson, S. R., Argonne National Lab., USA; Goretta, K. C., Argonne National Lab., USA; Mar. 1996, 12p; In English; Annual Meeting and Exhibition of the Minerals, Metals and Materials Society (TMS), 4-8 Feb. 1996, Anaheim, CA, USA

Contract(s)/Grant(s): W-31-109-eng-38

Report No.(s): ANL/ET/CP-87255; CONF-960202-28;

DE96-009047; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ag-clad Bi2.15SR1.83Ca1.02Cu2O(sub x) tapes were fabricated by the powder-in-tube method and heated in air to maximum temperatures of 880--895 C. The tapes were characterized by differential thermal analysis, scanning electron microscopy, energy-dispersive X-ray analysis, and X-ray diffraction. Microstructures of tapes that were heated at 885--895 C were similar, and, at a given temperature, remained stable for up to 1.0 h, which was the longest time used. The most significant microstructural features in specimens quenched from the melt were voids of up to (approx) 400 (mu)m in diameter. CuO was a minor phase in the melt, but grew significantly upon cooling to become the major non-superconducting phase when solidification was complete.
DOE

Thermal Analysis; X Ray Analysis; Microstructure; Silver; Cladding; Superconductivity

19960044580 Oak Ridge National Lab., Metals and Ceramics Div., TN USA

Spatial resolution of electron backscatter diffraction in a FEG-SEM

Kenik, Edward A., Oak Ridge National Lab., USA; [1996], 7p; In English; 54th; Annual Meeting of the Microscopy Society of America (MSA): Microscopy and Microanalysis, 11-15 Aug. 1996, Minneapolis, MN, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-960860-6; DE96-008656; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Crystallographic information can be determined for bulk specimens in a SEM by utilizing electron backscatter diffraction (EBSD), which is also referred to as backscatter electron Kikuchi diffraction. This technique provides similar information to that provided by selected area electron channeling (SAEC). However, the spatial resolutions of the two techniques are limited by different processes. In SAEC patterns, the spatial resolution is limited to approximately 2 micrometers by the motion of the beam on the specimen, which results from the angular rocking of the beam and the aberration of the probe forming lens. Therefore, smaller incident probe sizes provide no improvement in spatial resolution of SAEC patterns. In contrast, the spatial resolution for EBSD, which uses a stationary beam and an area detector, is determined by (1) the incident probe size and (2) the size of the interaction volume from which significant backscattered electrons are produced in the direction of the EBSD detector. The second factor is influenced by the accelerating voltage, the specimen tilt, and the relative orientation of scattering direction and the specimen tilt axis. This study was performed on a Philips XL30/FEG SEM equipped with a TexSEM Orientation Imaging Microscopy (OIM) system. The signal from the EBSD detector (SIT camera) is flat-fielded and enhanced in a MTI frame storage/image processor. The Schottky FEG source provides the fine probe sizes (approximately 10 nm) desired with sufficient probe current (approximately 1 nA) needed for image processing with the low signal/noise EBSD signal.
DOE

Crystallography; Electron Diffraction; Backscattering; Scanning Electron Microscopy; Signal Detectors; Signal to Noise Ratios; Spatial Resolution; Imaging Techniques

19960044610 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Development of the superconducting material application: Design of cryostat for testing high-Tc superconductors.

No, Kwang Su, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Yun, Dae Sung, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Heong, Seung Bum, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Lee, Jun Sung, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Wu, Song Su, Korea Advanced Inst. of Science and Technology, Korea, Republic of; Aug. 1995, 108p; In Korean
Report No.(s): KAERI-CM-095/94; DE96-761387; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

This study includes the confirmation of the optimum condition for the directional growth of the small area superconducting wire and the performance of the preliminary experiments on superconducting coils. It also comprises the directional growth of the area enlarged superconducting wires. However, due to several problems occurring with processing, it was difficult to perform the experiment. One of the problem was the excessive formation of the liquid phase which hindered the sample holding during the directional growth. Therefore, we tried 211 top layer and addition of excess 211 which were both found to be successful. However, owing to poor density and multi-domain, they showed small critical current density. For this reason, we have fabricated a directional growth apparatus for large area superconductor. The results of this study are expected to be used as a background data for the fabrication of the area enlarged superconducting wires in the near future. summarized.
DOE

Cryostats; High Temperature Superconductors; Superconductivity; Liquid Phases; Current Density; Superconductors (Materials)

19960044611 Ames Lab., IA USA

The crystal and molecular structure of azatranes: Azavanadatran (Z=t-Bu), monoazasilatrane (Z=H), azalithatrane (Z=ClO*4*), azaphosphatrane (Z=Me), azagermatrane (Z=t-Bu) and Azaalumatran (Z=nothing)

Wang, T., Ames Lab., USA; Apr. 23, 1996, 75p; In English
Contract(s)/Grant(s): W-7405-eng-82
Report No.(s): IS-T-1693; DE96-012076; No Copyright;

Avail: CASI; A04, Hardcopy; A01, Microfiche

The crystal and molecular structures of azatranes have been extensively studied for a variety of M atoms. The crystal and molecular structures of six similar cage compounds: (t-Bu)NV(MeNCH2CH2)(sub 3)N, HSi(OCH2CH2)(sub 2)(HNCH2CH2)N, O4ClLi(HNCH2SH2)(sub 3)N, MeP(Me3NCH2CH2)(sub 3)N, t-BuGe(HNCH2CH2)(sub 3)N, and Al(Me3SiNCH2CH2)(sub 3)N were determined by the use of three-dimensional, single crystal x-ray diffraction.
DOE

Crystal Lattices; Molecular Structure; Single Crystals; Crystal Structure; Germanium Compounds; Lithium Compounds; Organic Compounds

19960044643 Argonne National Lab., Materials Science Div., IL USA

Temperature-dependent study of ion-channeling in Fe/Cr superlattices

Rueders, F., Argonne National Lab., USA; Rehn, L. E., Argonne National Lab., USA; Baldo, P. M., Argonne National Lab., USA; Fullerton, E. E., Argonne National Lab., USA; Bader, S. D., Argonne National Lab., USA; May 1996, 26p; In English; 3rd; Joint International Symposium of the 1996 MRS-J Conference, 23-24 May 1996, Chiba, Chiba, Japan, Japan

Contract(s)/Grant(s): W-31109-eng-38

Report No.(s): ANL/MSD/CP-90170; CONF-9605188-1; DE96-011905; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Giant-Magneto-Resistance (GMR), as large as 150% at 4K, occurs in Fe/Cr superlattices as a result of antiferromagnetic interlayer coupling. The authors have successfully grown epitaxial single-crystal Fe/Cr multilayers using magnetron sputtering. Ion channeling was employed to study the structural and vibrational properties of the sputter-deposited Fe/Cr superlattices, and of a Cr thin film, between temperatures of 100 and 330K. Channeling in the latter specimen was used to investigate the importance of depositing a Cr buffer-layer in order to obtain superlattices with large GMR values. Once the buffer layer exceeded a critical thickness, a high quality Cr film was observed. The epitaxial quality of the superlattices grown on such buffer layers by sputtering was found to be excellent. Minimum yields nearly equal to theoretical predictions were found for channeling along the (001) growth direction; slightly higher values were found along the (111) axis. Because of the high structural quality of the sputter-deposited films, it was possible to investigate changes in thermal vibration amplitudes, even though their magnitude is only of the order of a few pm (10(exp -12) m). No unusual structural changes of this magnitude were observed in angular channeling scans obtained while cooling the Fe/Cr superlattice form 330 down to 100 K.
DOE

Superlattices; Iron; Chromium; Crystal Structure; Composite Materials; Magnetron Sputtering; Interlayers

19960044652 Sandia National Labs., Albuquerque, NM USA

Simplified models of growth, defect formation, and thermal conductivity in diamond chemical vapor deposition

Coltrin, Michael E., Sandia National Labs., USA; Dandy, David S., Colorado State Univ., USA; Apr. 1996, 21p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-0883; DE96-010374; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simplified surface reaction mechanism is presented for the CVD of diamond thin films. The mechanism also accounts for formation of point defects in the diamond lattice, an alternate, undesirable reaction pathway. Both methyl radicals and atomic C are considered as growth precursors. While not rigorous in all details, the mechanism is useful in describing the CVD diamond process over a wide range of reaction conditions. It should find utility in reactor modeling studies, for example in optimizing diamond growth rate while minimizing defect formation. This report also presents a simple model relating the diamond point-defect density to the thermal conductivity of the material.
DOE

Vapor Deposition; Thin Films; Thermal Conductivity; Surface Reactions; Methyl Compounds

19960045141 Tohoku Univ., Research Inst. of Electrical Communication., Sendai, Japan

Fabrication Process at 77K for High Temperature Superconducting Thin Film Devices

Nakamura, Hiroyuki, Tohoku Univ., Japan; Ogawa, Tomoya, Tohoku Univ., Japan; Chen, Jian, Tohoku Univ., Japan; Myoren, Hiroaki, Tohoku Univ., Japan; Nakajima, Kensuke, Tohoku Univ., Japan; Yamashita, Tsutomu, Tohoku Univ., Japan; The Record of Electrical and Communication Engineering Conversazione, Tohoku University; Mar. 1994; 62, no. 2, pp. 6-9; In Japanese; Also announced as 19960045139; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed a low temperature dry etching process using an excimer laser and a liquid nitrogen (77K) cyrostat for patterning high temperature (high T(sub c)) superconducting thin films. It has been found that the etching at cryogenic temperature can minimize the damages of superconductivity for patterned high T(sub c) films. As a result, YBa2Cu3O(7-x) bridges down to about 1 micron width with less degradation of transition temperature and critical current density (J(sub c)) were obtained. Furthermore, electrical parameters of fabricated devices can be adjusted to desirable values as the characteristics of devices can be monitored at 77K during the patterning. It is expected that such a process

is suitable for high T(sub c) superconducting thin film device fabrication.
Author
Fabrication; Superconducting Films; Etching; Excimer Lasers

19960045183 Flinders Univ., Electronic Structure Materials Centre., Adelaide, Australia
(e,2e) spectroscopy: from atoms to solids
Vos, M., Flinders Univ., Australia; McCarthy, I. E., Flinders Univ., Australia; Nov. 1994, 26p; In English
Report No.(s): ESM-91; DE96-623422; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

This paper describes briefly the theory of (e,2e) of atoms and molecules. Subsequently, introduces a simple model for a one-dimensional crystal. The (e,2e) spectra is calculated as would be measured for this hypothetical case, and use this model to make a link between (e,2e) spectroscopy as applied to atoms and molecules and this technique as applied to solids. Slight modifications of the model allow for the simulation of the effects of different band-structures on the (e,2e) spectra. Special attention is paid to the difference in the type of information obtained from (e,2e) spectroscopy and that obtained from angular resolved photo emission.
DOE
Crystal Structure; Atoms; Electron Spectroscopy; Molecular Structure; Molecules; Solids

19960045192 North Carolina State Univ., Raleigh, NC USA
Interface properties of wide bandgap Semiconductor structures *Semiannual Report, 1 Jul. 1995 - 31 Dec. 1995*
Nemanich, R. J., North Carolina State Univ., USA; Davis, Robert F., North Carolina State Univ., USA; Bedair, S., North Carolina State Univ., USA; Bernholc, J., North Carolina State Univ., USA; Sitar, Z., North Carolina State Univ., USA; Dec. 1995, 266p; In English
Contract(s)/Grant(s): N00014-92-J-1477
Report No.(s): AD-A304546; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A surface analytical study of bias enhanced nucleation of diamond on TiC(111) indicated that C vacancies form at the substrate and that the procedure may result in enhanced surface diffusion. Oriented diamond growth has been achieved on both (100) and (111) Ni substrates. A key aspect of the process is the formation of a molten Ni-C-H surface layer that promotes the nucleation of oriented particles. Experiments have been initiated to explore transmutation doping of B-doped homoepitaxial diamond by conversion of B to Li through neutron irradiation. Theoretical studies indicate that alternating exposure of hydrocarbon and fluorocarbon precursors may be suitable for ALE growth on diamond (110) surfaces. Field emission from diamond coated, needle shaped emitters demonstrated a significant enhancement of the total emission current and improved stability of the tip. A series of different ex situ chem ical based techniques have been explored for cleaning of 6H-SiC surfaces. Results indicated that 0 bonded to C on the surface was not easily removed. The impurity concentrations were measured for epitaxial SiC films on 6H-SiC(0001) and 3C-SiC(111) that were prepared by gas source MBE using S1H4 and C2H2. MIS diodes of Al/AlN/SiC were prepared by gas source MBE and characterized with C-V measurements. Ohmic contacts on p-type SiC were obtained using Ni/NiAl and annealing to 10000C. AIGaN films were grown directly on 6H-SiC, and the films were characterized with TEM, XRD, and cathodoluminescence.
DTIC
Diamonds; Nickel; Semiconductor Devices; Surface Diffusion; Hydrocarbons; Metal Surfaces; Molecular Beam Epitaxy; Neutron Irradiation; Coatings; Augmentation

19960045241 Sandia National Labs., Albuquerque, NM USA
Strong segregation gettering of transition metals by implantation-formed cavities and boron-silicide precipitates in silicon
Myers, S. M., Sandia National Labs., USA; Petersen, G. A., Sandia National Labs., USA; Follstaedt, D. M., Sandia National Labs., USA; Headley, T. J., Sandia National Labs., USA; Michael, J. R., Sandia National Labs., USA; Seager, C. H., Sandia National Labs., USA; 1996, 29p; In English; Spring Meeting of the European Materials Research Society, 4-7 Jun. 1996, Strasbourg, France
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-96-0612C; CONF-9606136-2; DE96-011837; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have mechanistically and quantitatively characterized the binding of transition-metal impurities in Si to cavities formed by He implantation and to B-Si precipitates resulting from B implantation. Both sinks are inferred to act by the segregation of metal atoms to pre-existing low-energy sites, namely surface chemisorption sites in the case of cavities and bulk solution sites in the case of the B-Si phase. These gettering processes exhibit large binding energies, and they are predicted to remain active for arbitrarily small initial impurity concentrations as a result of the segregation mechanisms. Both appear promising for gettering in Si devices.
DOE
Ion Implantation; Boron; Silicon; Transition Metals; Getters; Chemisorption; Precipitation (Chemistry)

19960045249 Joint Inst. for Nuclear Research, Dubna, USSR
Neutron diffraction study of YBa2Cu(sub 2.7)Zn(sub 0.3)O(sub 6+y) isotope enriched samples *Nejtronograficheskoe issledovanie struktury YBa(sub 2)Cu(sub 2.7)Zn(sub 0.3)O(sub 6+y)*

Balagurov, A.M., Joint Inst. for Nuclear Research, USSR; Sikolenko, V.V., Joint Inst. for Nuclear Research, USSR; Simkin, V.G., Joint Inst. for Nuclear Research, USSR; Parfenov, O.E., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Shil'shtejn, S.Sh., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; 1995, 18p; In Russian

Report No.(s): JINR-R-14-95-465; DE96-623716; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)) (US Sales Only), Microfiche

Neutron diffraction study of the structure of YBa2Cu(sub 2.7)Zn(sub 0.3)O(sub 6+y) has been performed using the isotope contrast method. Proportional distribution of Zn atoms between the Cu1 and Cu2 sites was found to be the most probable for a 10% concentration of Zn in the sample. From data analysis it was found that due to the substitution of two-valent cations (Zn, Ni) for copper a positive charge transfer to the CuO2 plane takes place, while for three-valent cation (Co, Fe) substitution a negative charge is transferred to the CuO2 plane.

DOE

Neutron Diffraction; Ytterbium Compounds

19960045256 California Univ., Accelerator and Fusion Research Div., Berkeley. Lawrence Berkeley Lab, CA USA

A 2D smart pixel detector for time-resolved protein crystallography

Beuville, E., California Univ., USA; Cork, C., California Univ., USA; Earnest, T., California Univ., USA; Mar, W., California Univ., USA; Millaud, J., California Univ., USA; Nygren, D., California Univ., USA; Padmore, H., California Univ., USA; Turko, B., California Univ., USA; Datte, P., California Univ., USA; Xuong, Nguyen-Huu, California Univ., USA; Oct. 1995, 11p; In English; 7th; SRI 1995: Synchrotron Radiation Instrumentation Symposium, 16-20 Oct. 1995, Argonne, IL, Argonne, IL, USA, USA

Contract(s)/Grant(s): DE-AC03-76SF-00098

Report No.(s): LBL-37542; LSBL-297; CONF-9510119-37; DE96-011511; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A smart pixel detector is being developed for Time Resolved Crystallography for biological and material science applications. Using the Pixel detector presented here, the Laue method will enable the study of the evolution of structural changes that occur within the protein as a function of time. The x-ray pixellated detector is assembled to the integrated circuit through a bump bonding process. Within a pixel size of 150 x 150 micro-m(exp 2), a low noise preamplifier-shaper, a discriminator, a 3 bit counter and the readout logic are integrated. The readout, based on the Column Architecture principle, will accept hit rates above 5 x 10(exp 8)/sq.cm/s with a maximum hit rate per pixel of 1 MHz. This detector will allow time resolved Laue crystallography to be performed in a frameless operation mode, without dead time. Target specifications, architecture, and preliminary results on the 8 x 8 front-end prototype and column readout are presented.

DOE

Crystallography; Proteins; X Ray Detectors; Laue Method; Pixels; Time Dependence

19960045268 Argonne National Lab., IL USA

Short range Tb(sup +3) spin correlations far above the two dimensional Neel temperature in Pb2SR2TbCu3O8

Staub, U., Argonne National Lab., USA; Soderholm, L., Argonne National Lab., USA; Skanthakumar, S., Argonne National Lab., USA; [1996], 16p; In English

Contract(s)/Grant(s): W-31109-eng-38

Report No.(s): ANL/CHM/PP-84084; DE96-007465; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Whereas the Tb(sup +3) moments undergo antiferromagnetic ordering at T(sub N) = 5.5 K, our susceptibility and inelastic neutron scattering experiments indicate that significant magnetic Tb-Tb short range correlations persist to temperatures T greater than or equal to 100 K. Magnetic correlations at such high temperatures relative to T(sub N) are very unusual and they may shed new light on the relation between superconductivity and rare earth magnetism in these systems.

DOE

Inelastic Scattering; Neutron Scattering; High Temperature Superconductors; Neel Temperature; Crystal Field Theory; Magnetic Permeability

19960045415 National Inst. for Fusion Science, Nagoya, Japan

Computer simulation and data compilation of sputtering yield by hydrogen isotopes (1)H(+), (2)D(+), (3)T(+), and helium (4)He(+) ion impact from monatomic solids at normal incidence

Tawaro, H., National Inst. for Fusion Science, Japan; Sakaoka, K., National Inst. for Fusion Science, Japan; Yamamura, Y., National Inst. for Fusion Science, Japan; Oct. 1995, 59p; In English

Report No.(s): NIFS-DATA-31; DE96-742581; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The ion-induced sputtering yields from monatomic solids at normal incidence are presented graphically for light-ion ((1)H(+), (2)D(+), (3)T(+), (4)He(+)) bombardment on various target materials as a function of the incident ion energy. to supplement the experimental data, the sputtering yields are calculated by the Monte Carlo simulation code ACAT for all possible light ion-target combinations. Each graph shows the available experimental and ACAT data points, together with the sputtering yield calculated by the Yamamura and Tawara empirical formula.

DOE

Light Ions; Monte Carlo Method; Ion Impact; Sputtering; Ion Beams; Solids

19960045434 Oak Ridge National Lab., Solid State Div., TN USA

Formation and properties of novel artificially-layered cuprate superconductors using pulsed-laser deposition

Norton, D. P., Oak Ridge National Lab., USA; Chakoumakos, B. C., Oak Ridge National Lab., USA; Budai, J. D., Oak Ridge National Lab., USA; Mar. 1996, 16p; In English; Oxide Superconductors: Physics and Nanongineering II, 27 Jan. - 2 Feb. 1996, San Jose, CA, USA

Contract(s)/Grant(s): DE-AC05-96OR-22464; AF Proj. 9637

Report No.(s): CONF-960163-18; DE96-009714; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pulsed-laser deposition and epitaxial stabilization have been effectively used to engineer artificially-layered thin-film materials. Novel cuprate compounds have been synthesized using the constraint of epitaxy to stabilize (Ca,SR)CuO2/(Ba,Ca,SR)CuO2 superconducting superlattices in the infinite layer structure. Superlattice chemical modulation can be observed from the x-ray diffraction patterns for structures with SRCuO2 and (Ca, SR)CuO2 layers as thin as a single unit cell (approximately)3. 4 A). X-ray diffraction intensity oscillations, due to the finite thickness of the film, indicate that (Ca,SR)CuO2 films grown by pulsed-laser deposition are extremely flat with a thickness variation of only approximately 20 A over a length scale of several thousand angstroms. This enables the unit-cell control of (Ca, SR)CuO2 film growth in an oxygen pressure regime in which in situ surface analysis using electron diffraction is not possible. With the incorporation of BaCuO2 layers, superlattice structures have been synthesized which superconduct at temperatures as high as 70 K. DC transport measurements indicate that (Ca, SR)CuO2/BaCuO2 superlattices are two dimensional superconductors with the superconducting transition primarily associated with the BaCuO2 layers. Superconductivity is observed only for structures with BaCuO2 layers at least two unit cells thick with T(sup c) decreasing as the (Ca,SR)CuO2 layer thickness increases. Normalized resistance in the superconducting region collapse to the Ginzburg-Landau Coulomb gas universal resistance curve consistent with the two-dimensional vortex fluctuation model.

DOE

Barium Oxides; Calcium Oxides; Copper Oxides; Beams (Radiation); Superconductors (Materials); Strontium Oxides; Pulsed Laser Deposition

19960045445 Lawrence Livermore National Lab., Livermore, CA USA

2l-nl(prime) x-ray transitions from neonlike charge states of the row 5 metals with 39 (le) Z (le) 46

Rice, J. E., Massachusetts Inst. of Tech., USA; Terry, J. L., Massachusetts Inst. of Tech., USA; Marmar, E. S., Massachusetts Inst. of Tech., USA; Finkenthal, M., Hebrew Univ., Israel; Safronova, U. I., Academy of Sciences (USSR), USSR; Fournier, K. B., Lawrence Livermore National Lab., USA; Goldstein, W. H., Lawrence Livermore National Lab., USA; Mar. 18, 1996, 12p; In English; 10th; American Physical Society (Aps) Topical Conference on Atomic Processes and Plasmas, 14-18 Jan. 1996, San Francisco, CA, USA

Contract(s)/Grant(s): DE-AC02-78ET-51013

Report No.(s): UCRL-JC-123537; CONF-960155-5; DE96-010241; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

X-ray spectra of 2l-2l(prime) transitions with 3 (le) n (le) 12 in the row five transition metals zirconium (Z = 40), niobium (Z = 41), molybdenum (Z = 42) and palladium (Z = 46) from charge states around neonlike have been observed from Alcator C-Mod plasmas. Accurate wavelengths (+/- .2 m(angstrom)) have been determined by comparison with neighboring argon, chlorine and sulfur lines with well known wavelengths. Line identifications have been made by comparison to ab initio atomic structure calculations, using a fully relativistic, parametric potential code. For neonlike ions, calculated wavelengths and oscillator strengths are tabulated for 2p-nd transitions in Y (Z = 39), Tc (Z = 43), Ru (Z = 44) and Rh (Z = 45) with n = 6 and 7. The magnitude of the configuration interaction between the (2p(sup 5))(sub 1/2)6d(sub 3/2) J = 1 level and the (2p(sup 5))(sub 3/2)7D(sub 5/2) J = 1 levels is demonstrated as a function of atomic number for successive neonlike ions. Measured spectra of selected transitions in the aluminum-, magnesium-, sodium- and fluorine like isosequences are also shown.

DOE

X Ray Spectra; Molybdenum; Niobium; Palladium; Atomic Structure; Fluorine; Oscillator Strengths; Tokamak Devices; Transition Metals; Zirconium; Argon

19960045461 Flinders Univ., Electronic Structure of Materials Centre, Adelaide, Australia

Energy-resolved electron momentum densities of diamond-structure semiconductors

Kheifets, A. S., Flinders Univ., Australia; Cai, Y. Q., Flinders Univ., Australia; Nov. 1994, 25p; In English

Report No.(s): ESM-92; DE96-623711; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

The linear muffin-tin orbital (LMTO) method has been used to calculate energy and momentum distributions of valence electrons in diamond, silicon, germanium and grey tin along zone axes (100), (110) and (111) directions and as the spherical average over the irreducible wedge of the Brillouin zone. These data can be used for interpreting results of (e,2e) experiments on single-crystal, polycrystalline and amorphous targets.

DOE

Energy Spectra; Momentum Transfer; Diamonds; Valence; Crystal Structure; Brillouin Zones; Energy Distribution

19960045562 Lawrence Livermore National Lab., Livermore, CA USA

1300-nm gain obtained with dysprosium-doped chloride crystals

Page, R. H., Lawrence Livermore National Lab., USA; Schaffers, K. I., Lawrence Livermore National Lab., USA; Beach, R. J., Lawrence Livermore National Lab., USA; Payne, S. A., Lawrence Livermore National Lab., USA; Krupke, W. F., Lawrence Livermore National Lab., USA; Mar. 1996, 10p; In English; Optical Amplifiers and Their Applications, 10 - 13 Jul. 1996, Monterey, CA, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-123523; CONF-9607106-1; DE96-010835; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Dy(3+) - doped chloride crystals have high 1300-nm emission quantum yields. Pump - probe experiments on La Cl3:Dy(3+) demonstrate optical gain consistent with predictions based on spectroscopic cross sections and lifetimes.

DOE

Amplifiers; Dysprosium Compounds; Lanthanum Chlorides; Optical Fibers; Optical Properties

19960045583 Yale Univ., Center for Microelectronic Materials and Structures., New Haven, CT USA

The growth of low band-gap InAs on (111)B GaAs substrates

Welser, Roger E., Yale Univ., USA; Guido, L. J., Yale Univ., USA; Space Photovoltaic Research and Technology 1995; Feb. 1996, pp. 137-141; In English; Also announced as 19960045564

Contract(s)/Grant(s): NGT-50832; NSF ECS-92-53760; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

Growth on the (111)B orientation exhibits a number of advantageous properties as compared to the (100) during the early stages of strained-layer epitaxy. In accordance with a developing model of nucleation and growth, we have deposited thin (60 A - 2500 A), fully relaxed InAs films on (111)B GaAs substrates. Although thicker InAs films are subject to the formation of twin defects common to epitaxy on the (111)B orientation, appropriate control of the growth parameters can greatly minimize their density. Using this knowledge base, InAs films up to 2 microns in thickness with improved morphology and structural quality have been grown on (111)B GaAs substrates.

Author

Indium Phosphides; Gallium Arsenides; Epitaxy; Nucleation; Substrates; Crystal Structure; Surface Properties

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19960042865 Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil

Soft and hard pomerons

Maor, Uri, Centro Brasileiro de Pesquisas Fisicas, Brazil; Sep. 1995; ISSN 0029-3865, 16p; In English; Theoretical Physics Symposium, 7-11 Aug. 1995, San Paulo, Brazil

Report No.(s): CBPF-NF-066/95; DE96-615052; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The role of s-channel unitarity screening corrections, calculated in the eikonal approximation, is investigated for soft Pomeron exchange responsible for elastic and diffractive hadron scattering in the high energy limit. We examine the differences between our results and those obtained from the supercritical Pomeron-Regge model with no such corrections. It is shown that screening saturation is attained at different scales for different channels. We then proceed to discuss the new HERA data on hard (PQCD) Pomeron diffractive channels and discuss the relationship between the soft and hard Pomerons and the relevance of our analysis to this problem.

DOE

Pomerons; Elastic Scattering; Hadrons; Eikonal Equation; Quantum Chromodynamics

19960044442 Oak Ridge National Lab., TN USA

Relative perturbation theory: (II) Eigenspace and singular subspace variations

Li, Ren-Cang, Oak Ridge National Lab., USA; Jan. 20, 1996, 36p; In English; 13th; Householder Symposium on Numerical Algebra, 14-22 Jun. 1996, Pontresina, Switzerland

Contract(s)/Grant(s): DE-AC05-96OR-22464; DAAL03-91-C-0047; ASC-9005933; 20552402; CDA-8722788; CDA-9401156

Report No.(s): CONF-9606199-1; DE96-010592; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The classical perturbation theory for Hermitian matrix enigenvalue and singular value problems provides bounds on invariant subspace variations that are proportional to the reciporcals of absolute gaps between subsets of spectra or subsets of singular values. These bounds may be bad news for invariant subspaces corresponding to clustered eigenvalues or clustered singular values of much smaller magnitudes than the norms of matrices under considerations when some of these clustered eigenvalues ro clustered singular values are perfectly relatively distinguishable from the rest. This paper considers how eigenvalues of a Hermitian matrix A change when

it is perturbed to (tilde A)= D(sup (asterisk))AD and how singular values of a (nonsquare) matrix B change whenit is perturbed to (tilde B)=D(sub 1)(sup (asterisk))BD(sub 2), where D, D(sub 1), and D(sub 2) are assumed to be close to identity matrices of suitable dimensions, or either D(sub 1) or D(sub 2) close to some unitary matrix. It is proved that under these kinds of perturbations, the change of invarient subspaces are proportional to reciprocals of relative gaps between subsets of spectra or subsets of singular values. We have been able to extend well-known Davis-Kahan sin (theta) theorems and Wedin sin (theta) theorems. As applications, we obtained bounds for perturbations of graded matrices.
DOE
Eigenvalues; Hermitian Polynomial; Matrices (Mathematics); Perturbation Theory

19960044454 Kurchatov (I. V.) Inst. of Atomic Energy, Moscow, USSR
Spinor representation of the Clebsch-Gordan coefficients *Spinornoe predstavlenie koehffitsientov Klebsha-Gordana*
Ivanov, A. A., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; Sionov, A. B., Kurchatov (I. V.) Inst. of Atomic Energy, USSR; 1994, 18p; In Russian
Report No.(s): IAE-5816/2; DE96-619775; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The deduction of the Clebsch-Gordan coefficients in frames of spinor algebra is realized. The spinor representation of these coefficients has the simplest form and the elementary physical interpretation. This result is of interest to first familiarity with the Clebsch-Gordan coefficients because the used method assumes the elementary knowledge about the permutation theory. The computer analytical systems are the good tools for calculation of these coefficients in tedious analytical computations.
DOE
Clebsch-Gordan Coefficients; Algebra; Analysis (Mathematics)

19960044509 International Centre for Theoretical Physics, Trieste, Italy
Constraint on the QED vertex from the mass anomalous dimension (gamma)(sub m) = 1
Bashir, A., International Centre for Theoretical Physics, Italy; Pennington, M. R., Durham Univ., UK; Oct. 1995, 12p; In English
Report No.(s): IC-95/353; DTP-95/92; DE96-617593; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

We discuss the structure of the non-perturbative fermion-boson vertex in quenched QED. We show that it is possible to construct a vertex which not only ensures that the fermion propagator is multiplicatively renormalizable, obeys the appropriate Ward-Takahashi identity, reproduces perturbation theory for weak couplings, and guarantees that the critical coupling, at which the mass is dynamically generated, is gauge independent but also makes sure that the value for the anomalous dimension for the mass function is strictly 1, as Holdom and Mahanta have proposed.
DOE
Quantum Electrodynamics; Fermions; Bosons; Gauge Theory

19960045414 Kyoto Univ., Yukawa Inst. for Theoretical Physics., Uji, Japan
A quantum group approach to c(sub L) greater than 1 Liouville gravity
Suzuki, Takashi, Kyoto Univ., Japan; Mar. 1995, 26p; In English
Report No.(s): YITP/U-95-07; DE96-742600; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A candidate of c(sub L) greater than 1 Liouville gravity is studied via infinite dimensional representations of U(sub q)sl(2, C) with q at a root of unity. We show that vertex operators in this Liouville theory are factorized into classical vertex operators and those which are constructed from finite dimensional representations of U(sub q)sl(2, C). Expressions of correlation functions and transition amplitudes are presented. We discuss about our results and find an intimate relation between our quantization of the Liouville theory and the geometric quantization of moduli space of Riemann surfaces. An interpretation of quantum space-time is also given within this formulation.
DOE
Correlation; Riemann Manifold; Gravitation; Relativity; Liouville Theorem; Boltzmann-Vlasov Equation; Quantum Theory

19960045425 Flinders Univ., Electronic Structure of Materials Centre., Adelaide, Australia
Convergent close-coupling method: a 'complete scattering theory'?
Bray, I, Flinders Univ., Australia; Fursa, D. V., Flinders Univ., Australia; Sep. 1995, 15p; In English
Contract(s)/Grant(s): AF Proj. 9545
Report No.(s): ESM-112; DE96-623383; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

It is demonstrated that a single Convergent Close-Coupling (CCC) calculation of 100 eV electron impact on the ground state of helium is able to provide accurate elastic and inelastic (n (less than or equal to 3 levels) differential cross sections, as well as singly-, doubly-, and triply-, differential ionization cross sections. Hence, it is suggested that the CCC theory deserve the title of a 'complete scattering theory'.
DOE

Mathematical Models; Electron Impact; Atomic Collisions; Helium; Ionization Cross Sections

19960045483 Joint Inst. for Nuclear Research, Dubna, USSR

Conserved currents for unconventional supersymmetric couplings of self-dual gauge fields

Devchand, Ch., Joint Inst. for Nuclear Research, USSR; Ogievetsky, V., Joint Inst. for Nuclear Research, USSR; 1995, 14p; In English

Report No.(s): JINR-E-2-95-461; DE96-623160; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

Self-dual gauge potentials admit supersymmetric couplings to higher-spin fields satisfying interacting forms of the first order Dirac-Fierz equation. The interactions are governed by conserved currents determined by supersymmetry. These super self-dual Yang-Mills systems provide on-shell supermultiplets of arbitrary extended super-Poincare algebras; classical consistency not setting any limit on the extension N. We explicitly display equations of motion up to the N=6 extension. The stress tensor, which vanishes for the N(less than or equal to) self-duality equations, not only gets resurrected when N=4, but is then a member of a conserved multiplet of gauge-invariant tensors.

DOE

Equations of Motion; Tensors; Supersymmetry; Fine Structure; Dirac Equation; Algebra

19960045484 Joint Inst. for Nuclear Research, Lab. of Theoretical Physics., Dubna, USSR

Analytic properties of (alpha)(sub s)(Q(sup 2)) and (tau) decay

Jones, H. F., Imperial Coll. of Science and Technology, UK; Solovtsov, I. L., Joint Inst. for Nuclear Research, USSR; 1995, 14p; In English; International Europhysics Conference on High Energy Physics, 27 Jul. - 2 Aug. 1995, Brussels, Belgium

Report No.(s): JINR-E-2-95-466; DE96-623237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

We describe a new non-perturbative expansion technique for QCD and its application to the problems of the analytic continuation of (alpha)(sub s)(Q(sup 2)) and the analysis of the inclusive semi-leptonic decay of the (tau) lepton.

DOE

Analytic Functions; Continuity (Mathematics); Leptons; Quantum Chromodynamics; Mapping; Perturbation Theory

19960045485 Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands

Non-standard quantum groups and superization

Majid, S., Cambridge Univ., UK; Rodriguez-Plaza, M. J., Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Netherlands; 1995, 28p; In English

Report No.(s): NIKHEF-H-95-023; DE96-623210; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We obtain the universal R-matrix of the non-standard quantum group associated to the Alexander-Conway knot polynomial. We show further that this nonstandard quantum group is related to the super-quantum group U(sub q)gl(1 vertical stroke 1) by a general process of superization, which we describe. We also study a twisted variant of this non-standard quantum group and obtain, as a result, a twisted version uf U(sub q)gl(1 vertical stroke 1) as a q-supersymmetry of the exterior differential calculus of any quantum plane of Hecke type, acting by mixing the bosonic x(sub i) co-ordinates and the forms dx(sub i).

DOE

Algebra; Differential Calculus; Supersymmetry; Lie Groups; Quantum Mechanics

19960045488 Tokyo Univ., Institute for Nuclear Study., Tanashi, Japan

The canonical connection in quantum mechanics

Levay, P., Technical Univ. of Budapest, Hungary; Mcmullan, D., Plymouth Univ., UK; Tsutsui, Izumi, Tokyo Univ., Japan; Apr. 1995, 20p; In English

Report No.(s): INS-1094; DE96-742599; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), Microfiche

In this paper we investigate the form of induced gauge fields that arises in two types of quantum systems. In the first we consider quantum mechanics on coset spaces G/H, and argue that G-invariance is central to the emergence of the H-connection as induced gauge fields in the different quantum sectors. We then demonstrate why the same connection, now giving rise to the non-abelian generalization of Berry's phase, can also be found in systems which have slow variables taking values in such a coset space.

DOE

Quantum Mechanics; Gauge Invariance; Transformations (Mathematics)

19960045503 Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands

Unitarity violation in non-abelian Pauli-Villars regularization

Leon, J. H., Universidad Autonoma de Madrid, Spain; Martin, C. P., Universidad Complutense, Spain; Ruiz, Ruiz F., Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Netherlands; 1995, 20p; In English

Report No.(s): NIKHEF-H-95-015; FTUAM-95/019; FT/UCM-04/95; DE96-623238; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We regularize QCD using the combination of higher covariant derivatives and Pauli-Villars determinants proposed by Slavnov. It is shown that for pure Yang-Mills theory

the Pauli-Villars determinants generate unphysical logarithmic radiative corrections at one loop that modify the beta function. Here we prove that when the gauge fields are coupled to fermions so that one has QCD, these unphysical corrections translate into a violation of unitarity. We provide an understanding of this by seeing that Slavnov's choice for the Pauli-Villars determinants introduces extra propagating degrees of freedom that are responsible for the unitarity breaking. This shows that Slavnov's regularization violates unitarity, hence that it should be rejected.
DOE
Quantum Chromodynamics; Fermions; Yang-Mills Theory; Quarks; Gauge Theory; Degrees of Freedom

19960045504 Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Inst. for High Energy Physics., Protvino, USSR
Single-spin asymmetries and invariant cross sections of the high-transverse-momentum inclusive (pi)(sup 0) production in 200 GeV/c pp and p-bar p interactions
Belikov, N. I., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Grachov, O. A., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Derevschikov, A. A., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Matulenko, Yu. A., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Meschanin, A. P., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Patalakha, D. I., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Rykov, V. L., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Solovianov, V. L., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Vasiliev, A. N., Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, USSR; Adams, D. L., Rice Univ., USA; Corcoran, M. D., Rice Univ., USA; Cranshaw, J., Rice Univ., USA; Nguyen, C., Rice Univ., USA; Roberts, J. B., Rice Univ., USA; Skeens, J., Rice Univ., USA; White, J. L., Rice Univ., USA; Akchurin, N., Iowa Univ., USA; Onel, Y., Iowa Univ., USA; Bystricky, J., Saclay Research Centre, France; Lehar, F., Saclay Research Centre, France; 1994, 25p; In English
Contract(s)/Grant(s): DE-AC02-76CH03000; W-31-109-eng-38; W-7405-eng-36; DE-AC02-76ER02289; DE-AS05-76ER05096
Report No.(s): IHEP-94-88; DE96-623253; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The E704 experiment at FNAL measured the (pi)(sup 0) inclusive and semi-inclusive single-transverse spin asymmetries in collisions of polarized proton and antiproton beams of 200 GeV/c with an unpolarized hydrogen target. The measured region was: x(sub F) = 0 +/- 0.15 and 1 less than p(sub T) less than 4.5 GeV/c. The asymmetries are consistent with zero within the error bars indicating that a RQCD expectation seems confirmed and the high twist contribution to single-spin effect in (pi)(sup 0) production at x(sub F) = 0 no be as large as was expected.
DOE
Antiprotons; Collisions; Hydrogen; Proton Beams; Asymmetry

19960045505 Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands
BRST gauge fixing and regularization
Sollacher, R., Uppsala Univ., Sweden; DeJonghe, F., Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Netherlands; Damgaard, P. H., Uppsala Univ., Sweden; May 1995, 16p; In English
Report No.(s): NIKHEF-H-95-017; UUITP-8/95; HEP-TH-9505040; DE96-623162; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the presence of consistent regulators, the standard procedure of BRST gauge fixing (or moving from one gauge to another) can require non-trivial modifications. These modifications occur at the quantum level, and gauges exist which are only well-defined when quantum mechanical modifications are correctly taken into account. We illustrate how this phenomenon manifests itself in the solvable case of two-dimensional bosonization in the path-integral formalism. As a by-product, we show how to derive smooth bosonization in Batalin-Vilkovisky Lagrangian BRST quantization.
DOE
Lagrangian Function; Quantum Mechanics; Gauge Invariance; Feynman Diagrams; By-Products

19960045506 Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam, Netherlands
An alternative BRST operator for topological Landau-Ginzburg models
DeJonghe, F., Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Netherlands; Termonia, P., Katholieke Univ. te Leuven, Belgium; Troost, W., Katholieke Univ. te Leuven, Belgium; Vandoren, S., Katholieke Univ. te Leuven, Belgium; May 1995, 13p; In English
Report No.(s): NIKHEF-95/025; KUL-TF-95/14; HEP-TH-9505174; DE96-623163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose a new BRST operator for the B-twist of N=2 Landau-Ginzburg (LG) models. It solves the problem of the fractional ghost numbers of Vafa's old BRST operator and shows how the model is obtained by gauge fixing a zero action. An essential role is played by the anti-BRST operator, which is given by one of the supersymmetries of the N=2 algebra. Its presence is needed in proving that the model is indeed a topological field theory. The space of physical observables, defined by taking the anti-BRST cohomology in the BRST cohomology groups, is unchanged.
DOE

Algebra; Gauge Invariance; Landau-Ginzburg Equations; Lagrangian Function; Field Theory (Algebra); Nonlinearity

19960045507 Joint Inst. for Nuclear Research, Dubna, USSR

Softly broken finite supersymmetric grand unified theory

Kazakov, D. I., Joint Inst. for Nuclear Research, USSR; Kalmykov, M. Yu., Joint Inst. for Nuclear Research, USSR; Kondrashuk, I. N., Joint Inst. for Nuclear Research, USSR; Gladyshev, A. V., Joint Inst. for Nuclear Research, USSR; 1995, 27p; In English

Report No.(s): JINR-E-2-95-482; DE96-623222; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

In the context of the standard SUSY GUT scenario we present the detailed analysis of the softly broken finite to all orders of perturbation theory SU(5) supersymmetric grand unified theory. The model albeit non-minimal remains very rigid due to the requirement of finiteness. The requirement of UV finiteness fixes all the Yukawa couplings at the GUT scale. Imposing the condition of universality on the soft couplings at the Planck scale and then extending the condition of finiteness to them, one gets a completely finite unified theory above M(sub GUT). The hierarchy of quark and lepton masses is related to that of v.e.v.'s of the Higgs fields and is governed by the Higgs mixing matrix in the generation space. Superpartners develop their masses according to the RG equations starting from the soft terms at the Planck scale. However, our suggestion of complete finiteness and maximal simplicity of the unified theory leads to the connection between the initial values of soft SUSY breaking parameters, namely m(sub 0)(sup 2)=1/3m(sub 1/2)(sup 2), A(sub t)=A(sub b)=A(sub (tau))=-m(sub 1/2), B=-m(sub 1/2), so that the number of free parameters is reduced compared to the MSSM.

DOE

Grand Unified Theory; Quarks; Leptons; Supersymmetry; Perturbation Theory

19960045510 Joint Inst. for Nuclear Research, Dubna, USSR

On QCD Q(sup 2)-evolution of deuteron structure function F(sub 2)(sup D)(x(sub D), Q(sup 2)) for x(sub D) greater than 1

Sidorov, A. V., Joint Inst. for Nuclear Research, USSR; Tokarev, M. V., Joint Inst. for Nuclear Research, USSR; 1995, 18p; In English

Report No.(s): JINR-E-2-95-454; DE96-623236; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

The deep-inelastic deuteron structure function (SF) F(sub 2)(sup D)(x(sub D),Q(sup 2)) in the covariant approach in light-cone variables is considered. The x(sub D) and Q(sup 2)-dependences of SF are calculated. The QCD analysis of generated data both for non-cumulative x(sub D) less than 1 and cumulative x(sub D) greater than 1 ranges was performed. It was shown that Q(sup 2)-evolution of SF is valid for ranges 0.275 less than x(sub D) less than 0.85 and 1.1 less than x(sub D) less than 1.4 for the same value of QCD scale parameter (Lambda). It was found the x(sub D)-dependence of SF for the ranges is essentially different.

DOE

Quantum Chromodynamics; Deuterons; Light-Cone Expansion; Inelastic Scattering

19960045516 Joint Inst. for Nuclear Research, Dubna, USSR

Zero-curvature representation for harmonic-superspace equations of motion in N=1, D=6 supersymmetric gauge theory

Zupnik, B. M., Joint Inst. for Nuclear Research, USSR; 1995, 26p; In English; Supersymmetry and Quantum Symmetries Workshop, 23-26 Sep. 1995, Dubna, Russia

Report No.(s): JINR-E-2-95-458; DE96-623159; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

We consider the SYM(sub 6)(sup 1) harmonic-superspace system of equations that contains superfield constraints and equations of motion for the simplest six-dimensional supersymmetric gauge theory. A special A-frame of the analytic basis is introduced where one equation for the harmonic connection A(sup --) can be solved. A dynamical equation in this frame is equivalent to the zero-curvature equation corresponding to the covariant conservation of analyticity. Using a simple harmonic gauge condition in the gauge group SU(2) we derive the superfield equations that produce the general SYM(sub 6)(sup 1) solution. An analogous approach to the analysis of integrability for SYM-SG-matter systems in HS is discussed briefly.

DOE

Equations of Motion; Measuring Instruments; Harmonic Motion; Supersymmetry; Gauge Theory

19960045548 Joint Inst. for Nuclear Research, Dubna, USSR

Quark mass correction to the string potential

Lambiase, G., Salerno Univ., Italy; Nesterenko, V. V., Joint Inst. for Nuclear Research, USSR; 1995, 42p; In English

Contract(s)/Grant(s): RRF-93-02-3972

Report No.(s): JINR-E-2-95-443; DE96-623158; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; US Sales Only; US Sales Only

A consistent method for calculating the interquark potential generated by the relativistic string with massive ends is proposed. In this approach the interquark potential in the model of the Nambu-Goto string with point-like masses at its ends is calculated. At first the calculation is done in the one-loop approximation and then the variational estimation is performed. The quark mass correction results in decreasing the

critical distance (deconfinement radius). When quark mass decreases the critical distance also decreases. For obtaining a finite result under summation over eigenfrequencies of the Nambu-Goto string with massive ends a suitable mode-by-mode subtraction is proposed. This renormalization procedure proves to be completely unique. In the framework of the developed approach the one-loop interquark potential in the model of the relativistic string with rigidity is also calculated.
DOE
Quarks; Strings; String Theory; Boundary Value Problems; Equations of Motion; Euclidean Geometry; Perturbation Theory; Variational Principles